OCTOBER 19, 1953

Electrical World

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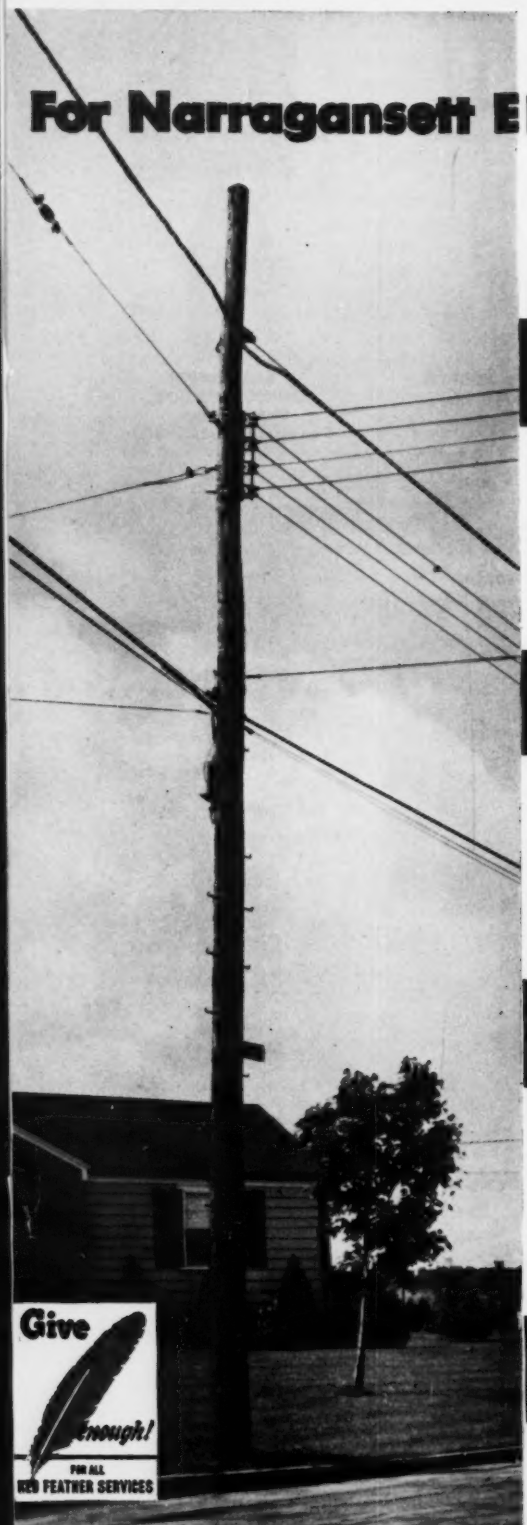
For Narragansett Electric Co Aerial Cable Provides



Storm Protection

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See Page 114

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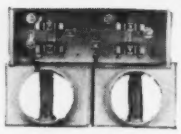
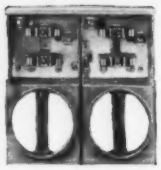
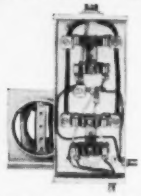


SOCKET METER TROUGHS
Indoor gangable.

SOCKET METER TROUGHS WITH AND WITHOUT HUBS



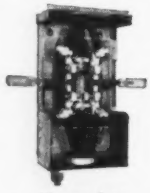
Raintight type — horizontal.



Raintight type — vertical.

SOCKET METER MOUNTINGS — RAINTIGHT TYPE

Medium duty, single phase and polyphase.



Heavy duty.
Up to 200 Amperes.

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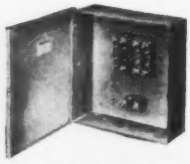

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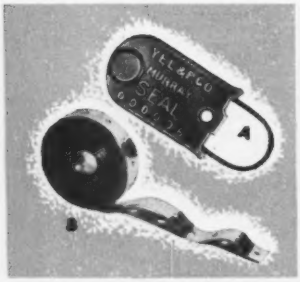

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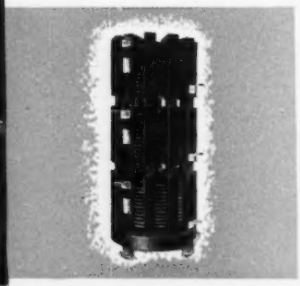

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Meet This Week's Writers

How aerial cable has storm-proofed a portion of Narragansett Electric Co's distribution system is discussed on page 114 by Fred Sciotti, overhead distribution engineer for the utility. The author, who is 49, will mark his 25th year with Narragansett Electric next February.

FRED SCIOTTI

A holder of a B. S. degree in electrical engineering from Brown University, he specializes in overhead distribution. A former lieutenant colonel in the Signal Corps and holder of the Bronze Star, he is married and has one son, Robert. His leisure time goes towards developing his photographic talent.

Expanding on the Tennessee Valley Authority's microwave setup on page 124 is G. E. Farmer, chief of the Communication Engineering Branch. Everett, as he's known to friends, is 55 and has been with TVA since 1938.

G. E. FARMER

Holder of a B.S. degree in electrical engineering from the Massachusetts Institute of Technology, he includes in his professional experience six years spent with the Southern California Edison Co. Now living in Signal Mountain, Tenn., a suburb of Chattanooga, he is active in youth and school system activities. Interested in the scouting movement since his youth, he is a holder of the Silver Beaver award for adult leadership.

One of his two boys is a graduate of the Agricultural School at the University of Tennessee and the other is studying forestry at the University of the South. His only daughter is attending high school in Chattanooga.

Electrical World

Published for 79 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

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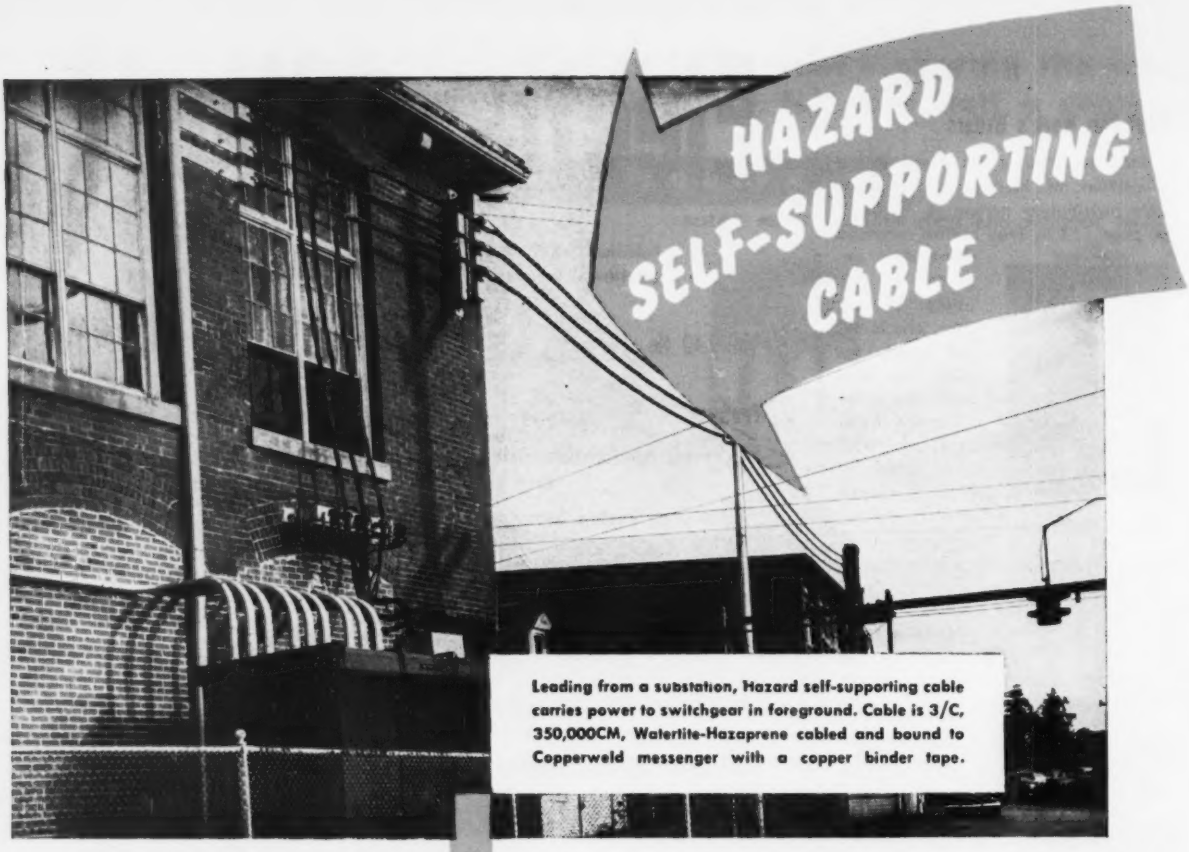


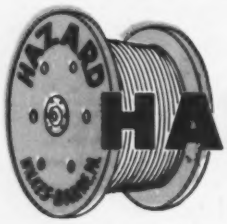
Leading from a substation, Hazard self-supporting cable carries power to switchgear in foreground. Cable is 3/C, 350,000CM, Watertite-Hazaprene cabled and bound to Copperweld messenger with a copper binder tape.

delivers the goods AT ANCHOR ROME TEXTILE MILLS

In a recent modernization at the Rome, Georgia plant of Anchor Rome Mills, Hazard Watertite-Hazaprene Self-Supporting Aerial Cable was used. Here, you can see the extreme flexibility of the installation . . . it can be strung close to buildings and existing structures with complete safety.

The excellent electrical and physical characteristics of Watertite-Hazaprene were important in the selection of power cable at Anchor Rome Mills. Watertite insulation provides the needed moisture and heat resistance with toughness, resilience and high dielectric strength. The rugged, weather-resistant Hazaprene sheath—the same used for Hazard mining cables—assures long-lived dependability.

Of additional advantage to industrial installations is the "three-in-one" construction of Hazard self-supporting cable. Pre-assembled cable, messenger and binder provides safety, low cost, quick installation and neat appearance. Relocation, when needed, is a simple operation. Get the complete story on dependable, money-saving industrial aerial power circuits from your Hazard representative or write today . . . Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

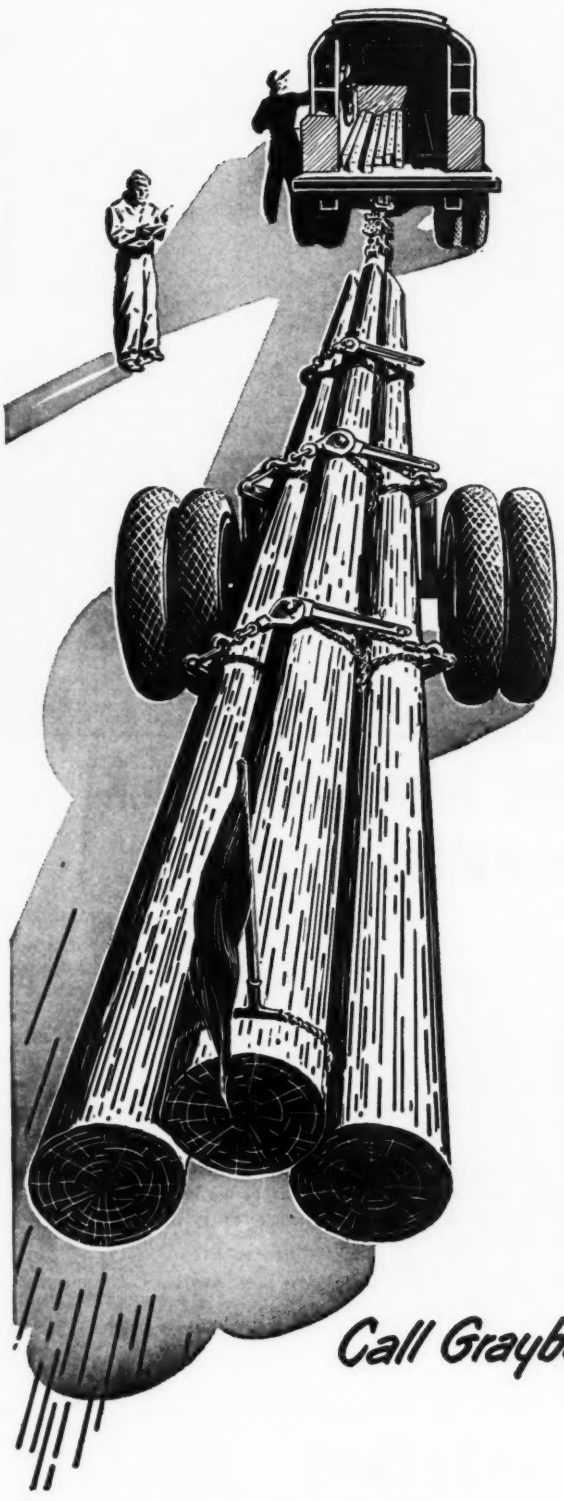


HAZARD *insulated cords and cables*

1443

POLES and CROSSARMS

– via GraybaR



There's a type of pole and crossarm for every power-line requirement. And an order placed with Graybar means that you can get the kind you need *when* and *where* you need it.

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Graybar-distributed crossarms are seasoned under rigid methods – are strong, long-lasting and provide a wide margin of safety in the line.

For help in solving usual, and *unusual*, pole-line problems, call on Graybar Outside Construction Specialists – they're located in key areas throughout the nation. And for convenience, speed and direct action, route all your line material orders via Graybar. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, 420 Lexington Avenue, New York 17, N. Y.*

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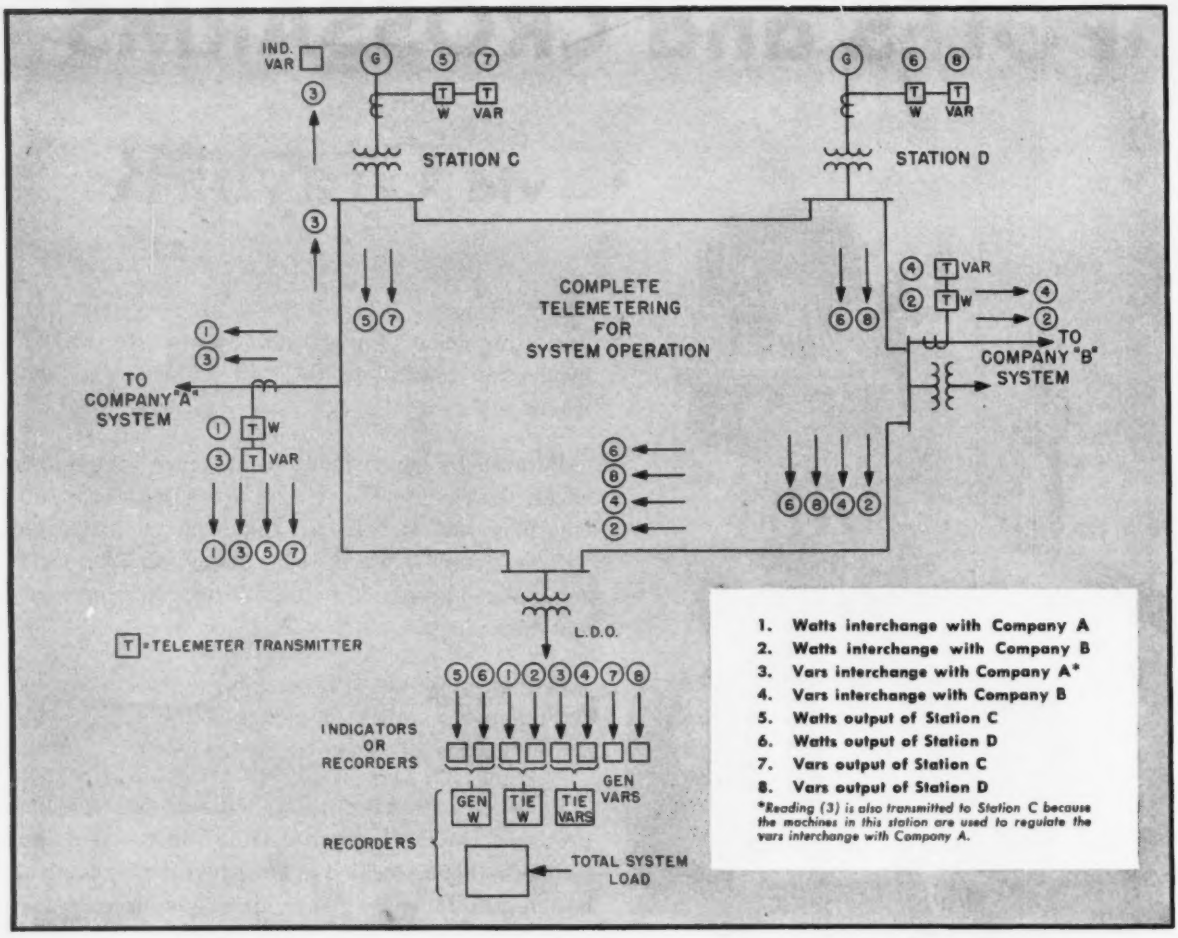
IND. VAR
STATION C
STATION D
COMPLETE TELEMETERING FOR SYSTEM OPERATION
TO COMPANY "A" SYSTEM
TO COMPANY "B" SYSTEM
L.D.O.
T = TELEMETER TRANSMITTER
INDICATORS OR RECORDERS
GEN VARS
RECORDERS
GEN W
TIE W
TIE VARS
TOTAL SYSTEM LOAD
1. Watts interchange with Company A
2. Watts interchange with Company B
3. Vars interchange with Company A*
4. Vars interchange with Company B
5. Watts output of Station C
6. Watts output of Station D
7. Vars output of Station C
8. Vars output of Station D
*Reading (3) is also transmitted to Station C because the machines in this station are used to regulate the vars interchange with Company A.

G-E Telemetering Provides Immediate Check of Entire Power Generating System

Above is a complete telemetering network for one generating system. The diagram shows how this network instantly supplies system load dispatches with eight essential checks on power generation.

Only continuous system-wide telemetering can bring you all of these essential readings: active and reactive power in the tie lines and other key points, generating station power and reactive power, loading of critical tie lines, and net power interchange.

G-E telemetering equipment is available for carrier-current channels, microwave channels and wire-line channels. You are assured of a completely co-ordinated system because all the equipment is designed, manufactured, sold, and serviced by only one company.

FAST RECORDER RESPONSE is available with the G-E telemetering system. With any nominal two-second electronic recorder, the response time is less than two seconds for 90 per cent of full scale.

Also, since indicating milliameters can be used when a record is not needed, the expense of charts and maintenance of narrow or wide chart recorders is limited to those places where recording is essential.

GREATER ECONOMY in use of carrier channels is provided because the maximum telemeter frequency is only 27 cps. This permits the use of narrow-bank, crystal-controlled carrier equipment for any frequency in the 30 to 200 kc range.

MORE ACCURATE, STABLE TRANSMISSION is assured by the wide range of the telemeter signal frequency (6 to 27 cps). Such telemeters are inherently less susceptible to transient channel disturbances.

For more information contact your nearest G-E apparatus sales office, or write for bulletin GEA-5746, Section 605-38A, General Electric Company, Schenectady 5, N. Y.

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FEATURES OF GRINNELL MODEL R CONSTANT SUPPORT HANGER:

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- Can be bolted directly to the building structure or suspended by either single or double rods

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Mathematically perfect constant support for all positions of travel of high temperature process and steam piping

With the new Grinnell Model R Constant Support, the pipe, its covering and contents, are supplied mathematically perfect support in all positions of travel. In addition, constant support is maintained throughout the full range of field adjustability.

The design of the new Model R provides favorably small ratios between spring force and the supported load, ranging from 1.15 to 1 minimum and 4 to 1 maximum, thereby minimizing bearing stress and prolonging the life of the hanger. This permits hangers which are smaller in size for the loads carried.

If conditions require a change of supporting force, a load scale is provided so that accurate field adjustments of at least plus or minus 10% may be made by turning a *single* load adjusting bolt. Wherever the adjustment is set, the Model R gives a load deflection curve that is a straight horizontal line.

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Projection of load growth and of maximum fault current may indicate the selection of breakers of far higher rating than present load requires.

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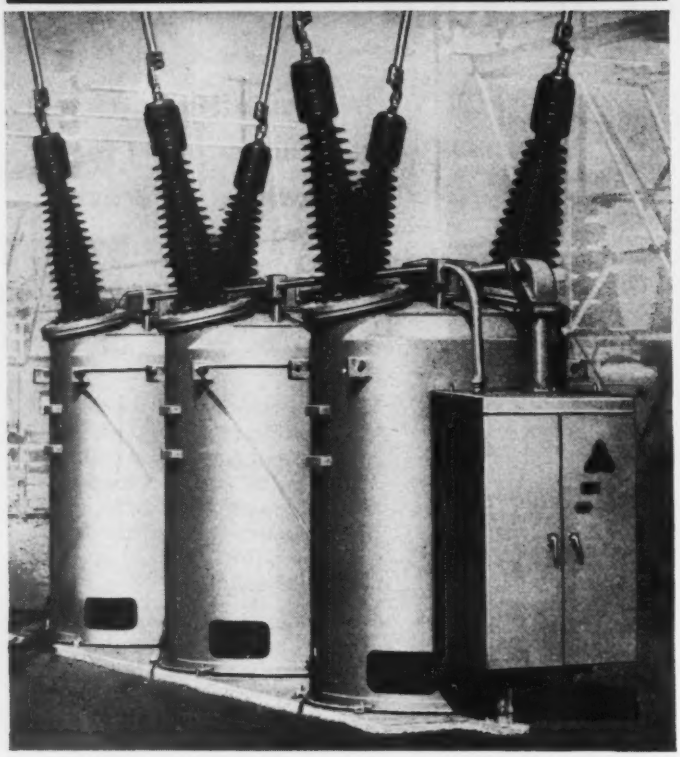
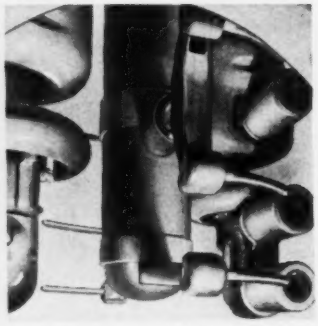
196/230, 230, and 287 kv — 3 cycles
to 10,000,000 interrupting kva (ASA)
at 161, 230, and 287 kv

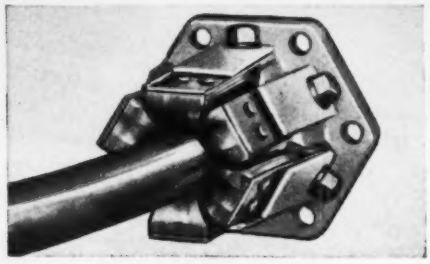


At Left:
One of Fifteen Type RHE-78, 161 kv, 10,000,000 int. kva for Electric Energy, Inc., Joppa, Illinois.

At Right:
Interior of Tank; a single rotary structure connects six interrupters in series (three are shown).

Below:
Moving Contact Entering Nest of Six Sliding-Shoe (finger) Contacts.





These features contribute to Pacific's Proved Protective Performance . . .

Nested Sliding-Shoe Contacts

PACIFIC'S Continued use of the reliable nested sliding-shoe (finger) form of contact, even for the largest circuit breakers, is now supported by the industry trend when severe conditions are to be met.

The stationary and moving contact surfaces of the contacts are silver Elkonite, of such form that arc foot prints are confined to portions of the surfaces that do not carry load current.

The stationary contact structure of each pole comprises six sets of contacts in series, each of either four or six shoes, depending on rating. Voltage division between the sets of contacts is aided by capacitance grading shields.

Proved Interrupters

Pacific interrupters are of simple self-pressurizing type; their exceptional performance is due to improved utilization of directed oil flow and to high speed of developing open-gap distance.

Other Features

- Only one moving structure within the tank.
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"POT HOLDER"- Industrial Style

Photo Courtesy Wellman Engineering Co.

This is the industrial equivalent of the domestic pot holder. The charging and drawing machine picks up heavy ingots and puts them into and removes them from the furnace.

Overhead trolleys, as well as third rails, are frowned upon as sources of power because of safety reasons and so the steel mill wisely chose TIREX Cables for the important job of supplying electric power to this machine.

The user knows better than anyone else how important this machine is to his operation. So he uses cured-in-lead TIREX to insure the dependable operation of this charging machine. The cable is subjected to heat, to flying sparks, to oil, abrasion and other harmful agents. It is reeled and unreeled all day long. Even this doesn't bother the Selenium Neoprene Armor.

Isn't the fact that this steel mill depends upon TIREX Cables ample evidence of their superiority? Doesn't this mean you could profit by their experience? We think so, too. Why don't you specify and be sure you get TIREX for every type of portable cord or cable operation? You will not be sorry you placed your faith in TIREX.

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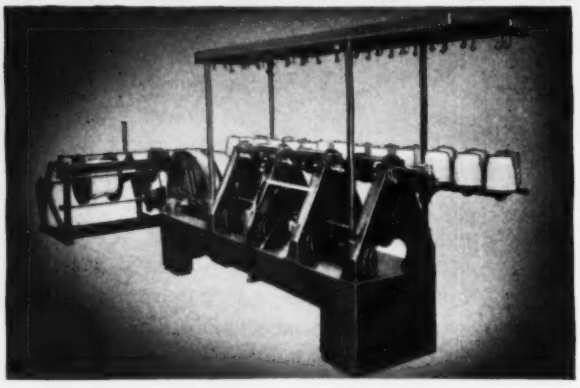

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Helping to make Kanawha's record possible are two B&W Radiant Reheat Boilers, the largest pressure-fired units in the world, incorporating many advanced engineering principles.

Pressure-Firing

The smooth operation of these units can be attributed, in a large part, to B&W pressure-firing. This also contributes to the high thermal efficiency. These boilers were started up and operated without the use of standby induced-draft fans.

These two new units are the eighth and ninth in the American Gas system which are pressure operated, the first having gone into service more than four years ago. *There are now more than 15 large coal-fired pressurized B&W boilers in operation.* More than 70 additional pressure-fired units are under construction.

Cyclone Steam Separators

Positive natural circulation is assured by the B&W Cyclone Steam Separators at the drum design pressure of 2400 psi. Turbine efficiency is maintained and turbine outages for blade cleaning are reduced since the steam from the Cyclone Steam Separator and steam scrubber is of exceptional purity.

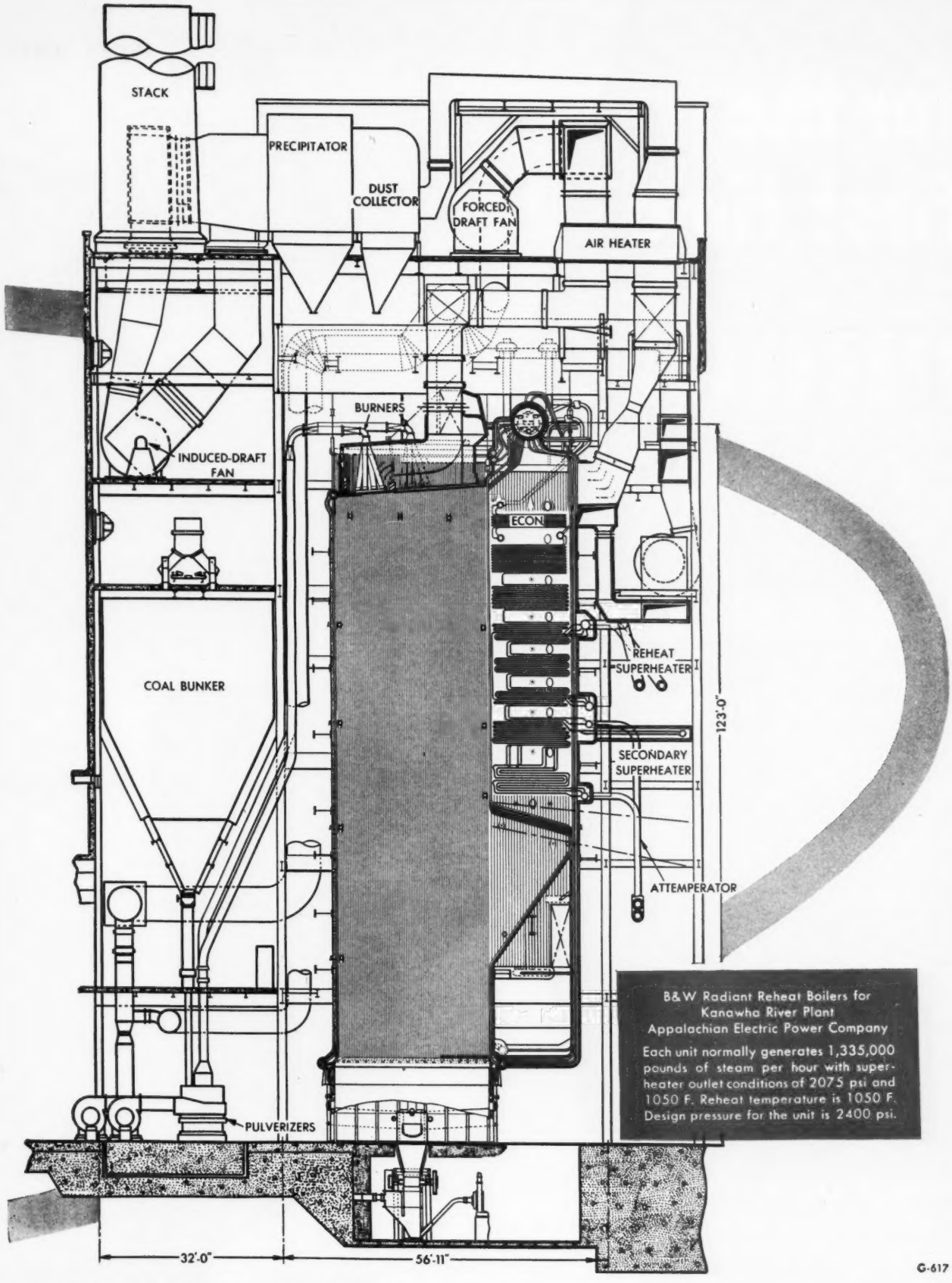
Divided Furnace Construction

Building volume has been held to a minimum and slag build-ups on convection surface have been reduced by the use of B&W's simple divided-furnace construction. The heating surface of the furnace division wall is used to the maximum since heat is absorbed on both sides.

These are but a few of the many ingredients that go into the making of low-cost kilowatts. One of the most important requirements is *experience*, and B&W will be pleased to place at your disposal the benefit of its knowledge gained through actual long-time experience with modern central-station boilers.

BABCOCK & WILCOX

BOILER DIVISION



B&W Radiant Reheat Boilers for Kanawha River Plant Appalachian Electric Power Company

Each unit normally generates 1,335,000 pounds of steam per hour with superheater outlet conditions of 2075 psi and 1050 F. Reheat temperature is 1050 F. Design pressure for the unit is 2400 psi.

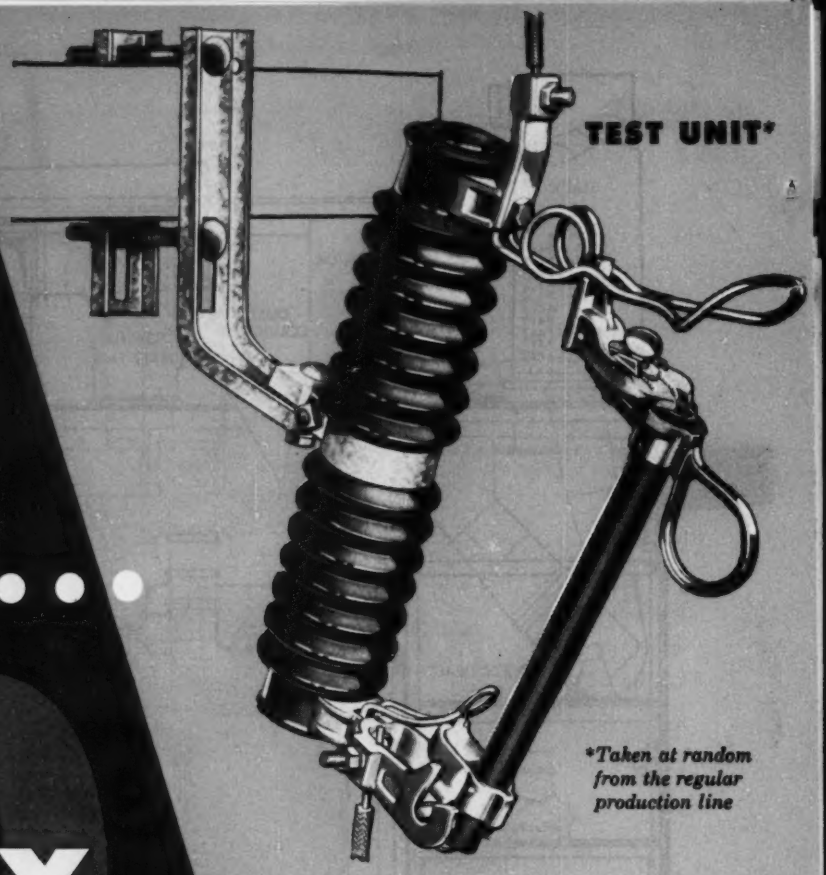
G-617

for the first time

PROOF...

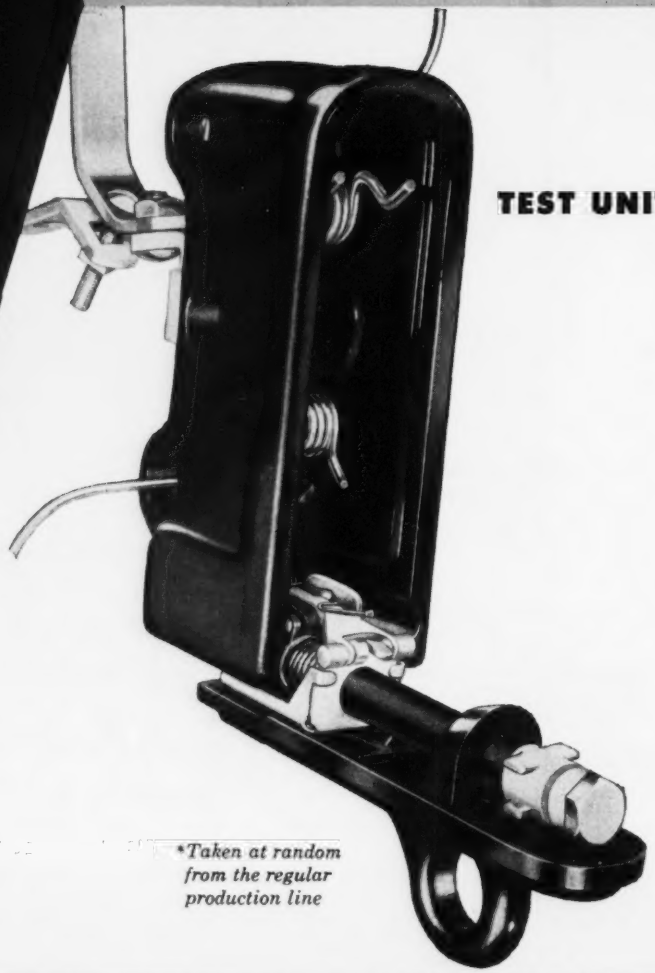
HD

KEARNEY



TEST UNIT*

*Taken at random from the regular production line



TEST UNIT*

*Taken at random from the regular production line

Specify

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO. GUELPH, ONT.

JAMES R. KEARNEY CORP.
4224-42 Clayton Avenue
St. Louis 10, Missouri
Canadian Plant: Guelph, Ontario

Standard HEAVY DUTY TRIP-OUT 16234-3

RATING: 100 amperes, 15 KV.

TEST DATA

Voltage 14,400 KV; Power Factor 20%; X/R=4.88

Cutout Cat. No.	Test No.	Current Amperes RMS	Clearing Time Cycles	Kearney Fuse Link	
				Rating	Type
16234-3	1	8050	½+	80	200-U
100 Amp.	2	7620	½+	80	200-U
15 KV	3	8750	½+	80	200-U
	4	8320	½+	80	200-U
	5	8750	½+	100	200-U
	6	7900	2½	100	KS-U

RESULTS: At 14.4 KV with a power factor of 20%, the cutout sucessfully interrupted six shots ranging from 7620 to 8750 amperes, RMS. After the sixth shot both the cartridge and contacts were carefully examined and found to be in perfect working condition.

After the short circuit test, without adjustment of any kind, the cutout was tested for temperature rise. The maximum was 13° C, as compared to 30° allowable by NEMA for new cutouts.

ACTUAL TEST DATA on Short Circuit Interruption PROVES KEARNEY HEAVY DUTY Cutouts Have Ample Interrupting Capacity for Today's Heavy Loads

Standard HEAVY DUTY TRIP-O-MATIC indicating 12143-20 non-indicating 12143-21

TEST DATA

Voltage: 5046; Power Factor: 20%; X/R=4.88

Cutout Cat. No.	Test No.	Current Amperes RMS	Clearing Time Cycles	Kearney Fuse Link	
				Rating	Type
12143-20	1	7250	1	50	KS
100 Ampere	2	7680	1	80	200
5 KV	3	6620	1	80	200
Indicating	4	6200	1½	80	200
	5	7850	1	100	200
	6	6400	1½	100	200
	7	6600	1	100	200
	8	6200	1½	100	200
	9	7250	1	100	200
12143-20	1	6600	1	100	200
(original box)	2	6880	1	100	200
(with new door)	3	7050	1½	100	200
12143-21	1	2900	1½	50	200
100 Ampere	2	4250	2½	100	200
5 KV	3	7850	1	50	KS
Non-Indicating	4	6750	1	50	KS

RATING: 100 ampere, 5 KV.

RESULTS: At 5 KV with a power factor of 20%, the indicating Trip-O-Matic successfully interrupted nine shots ranging from 5500 to 6350 amperes, RMS, at 5046 volts. Then three additional tests were made on the same box with a new door installed. 5800, 5750 and 6050 amperes were successfully interrupted. The non-indicating Trip-O-Matic successfully interrupted four shots ranging from 2800 to 6000.

After the short circuit tests, a heat run was made on the same non-indicating box. Maximum temperature rise was found to be 21° C, as compared to 30° allowable by NEMA for new cutouts.

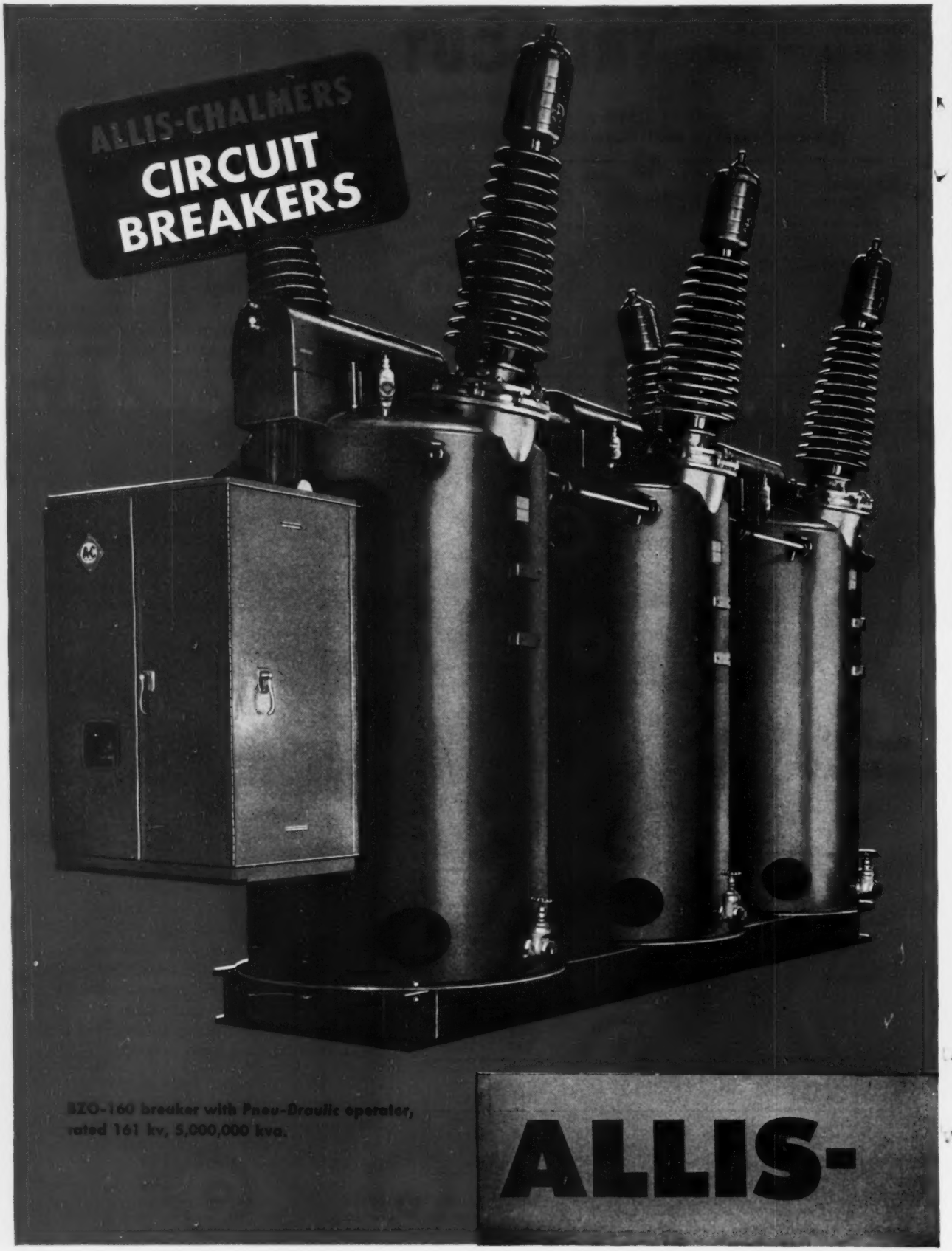
TEST SET-UP: This circuit interruption data is *not based on calculation*. It is the result of actual field tests at Kearney's 34.5 KV substation. Power was taken from the Union Electric circuit providing a 445,000 KVA back-up. In the Heavy Duty Trip-Out tests, faults were made on the 15 KV side of a 10,000 KVA transformer. In the Heavy Duty Trip-O-Matic tests, faults were made on the 5 KV side of the same transformer.

These test results are proof-positive that Kearney cutouts protect your circuits with *even greater* capacity than their normal ratings.

JAMES R. KEARNEY CORPORATION ST. LOUIS, MO.

FOR BETTER CONSTRUCTION . . . SAFER MAINTENANCE

242


ALLIS-CHALMERS
CIRCUIT BREAKERS
BZO-160 breaker with Pneu-Draulic operator, rated 161 kv, 5,000,000 kva.
ALLIS-

All Breakers Completely Assembled

PRIOR TO SHIPMENT

Installation of Allis-Chalmers Breakers is FAST... EASY

Every detail gets thorough going-over in factory. For example: every breaker is completely assembled and test operated. Parts are marked for alignment — numbered — tagged — for easy, fast field assembly.

Breaker quickly installed — no guesswork — no delays!

Reliability is another feature! Allis-Chalmers breakers in all sizes, all types of operators are full mechanically trip-free. Breaker trips instantly at *full speed* even when operator is closing.

To get these important features on your breakers — specify Allis-Chalmers.

For complete breaker story, call your nearby A-C district office, or write Allis-Chalmers, Milwaukee 1, Wisconsin.

The Secret of FAST Contact Alignment

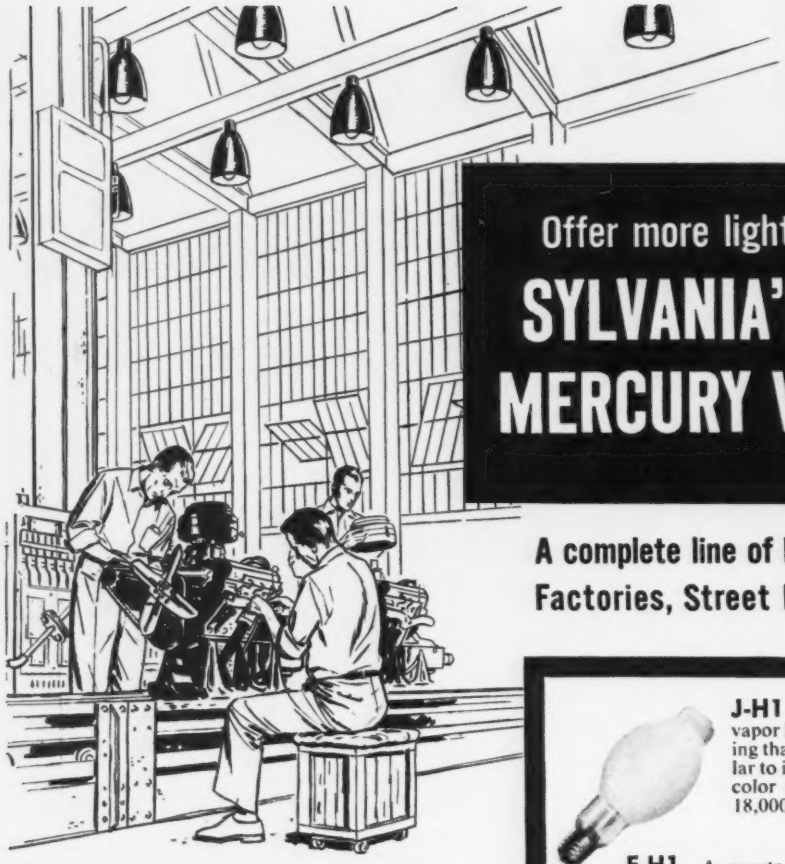
Adaptor ring eliminates time loss in alignment. Adaptor rings and bushings are factory aligned and marked for ease of installation during field assembly. Adaptor rings are left in position during shipment. Field assembly time is greatly reduced. Bushing seat gaskets are properly weather sealed by tightly secured bushing flange bolts.

A-4152

Pneu-Draulic is an Allis-Chalmers trademark.

CHALMERS

A-C ALLIS-CHALMERS



Offer more light at lower cost with

SYLVANIA'S IMPROVED MERCURY VAPOR LAMPS

A complete line of Mercury Vapor Lamps for Factories, Street Lighting, Flood Lighting

J-H1 – This latest development in mercury vapor lamps features a special phosphor coating that provides a "Golden white" light similar to incandescent. Especially valuable where color determination is important. Rated at 18,000 lumens, 400 watts.

E-H1 – A quartz arc lamp developed primarily for street lighting and "high bay" industrial lighting. Operates in any position. Rated at 400 watts, delivers 20,000 lumens.

C-H5 – A smaller size of the E-H1 type, for general applications demanding good all-over lighting at minimum cost. Also used as a source of "Blacklight" radiation. 250 watts, 11,000 lumens.

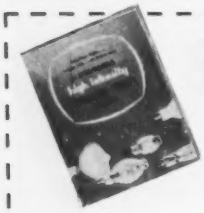
A-H1 – A popular, low cost mercury lamp for street and industrial lighting. Rated at 400 watts with an output of 15,000 lumens

K-H1 – A reflector mercury lamp for general industrial lighting. Ideal for smoky factory conditions. Sealed-in reflector stays clean and bright, assuring high lumen output at low maintenance costs.

Modern plants and municipalities alike are turning more and more to efficient, money-saving mercury vapor lamps.

In keeping with this trend, Sylvania now offers an outstanding line of improved mercury vapor lamps to meet the requirements of any application. These lamps offer several times the life of incandescent bulbs. And, they provide double the light output for the same amount of wattage. As a result, they reduce your customers' maintenance and fixture costs. Improve seeing conditions, speed production, too.

Your own city lighting people will probably be glad to learn more about these new mercury vapor lamps. Illustrated folder gives full details and characteristics Mail the coupon for your file copy NOW!



Sylvania Electric Products Inc.
Dept. 3L-2710, 1740 Broadway
New York 19, N. Y.

Please send me illustrated folder MV-401, describing the full line of Sylvania Mercury Vapor Lamps.

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Meet L. L. Wrentmore,

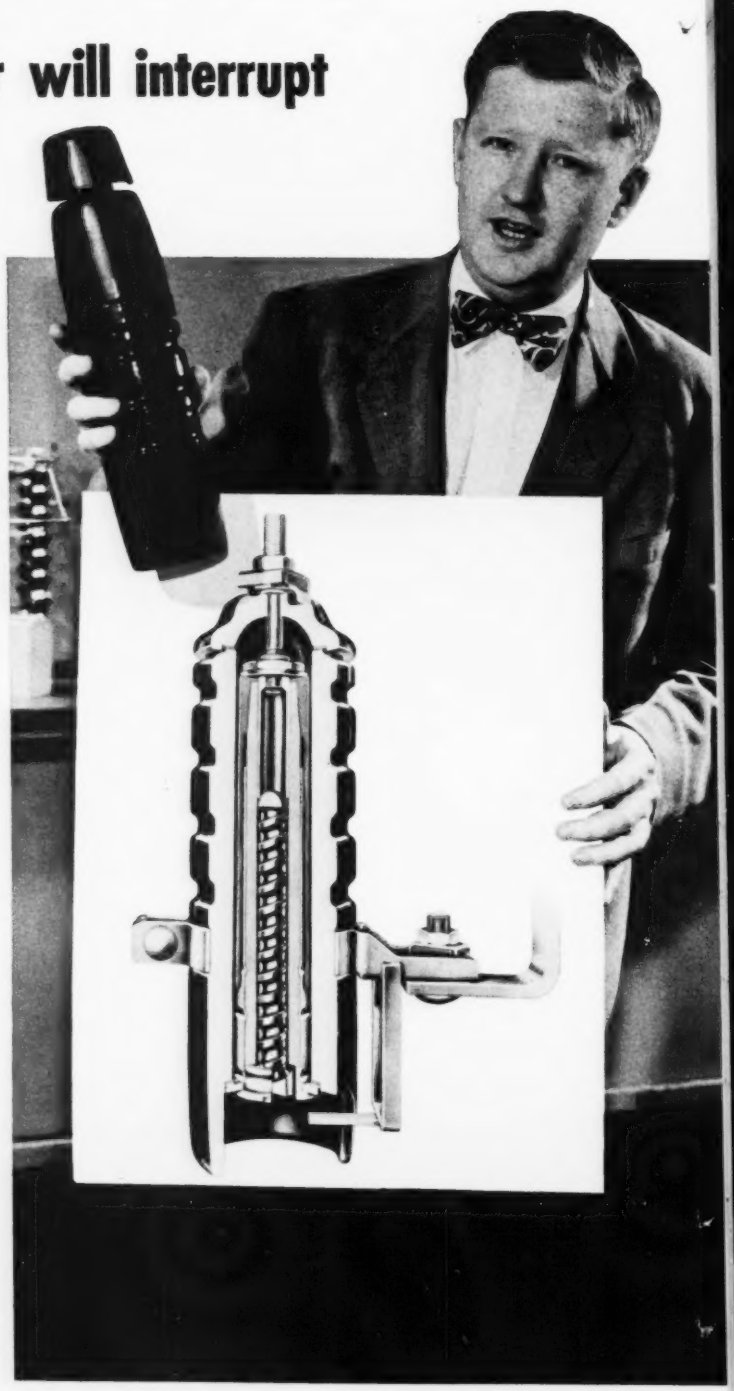
Westinghouse Distribution Apparatus Manager. On the following seven pages, he discusses new developments in distribution apparatus and some of the important points to consider in selecting protective equipment.

How modern equipment provides a new level of distribution protection

Larry Wrentmore is Mr. Distribution Apparatus at Westinghouse and a 27-year veteran. Originally a utility man, he has served in Westinghouse district offices in direct contact with utility problems. For the past nine years at East Pittsburgh, he has brought his experience to bear across the board and is a recognized authority on distribution apparatus problems.

"Expulsion or valve arresters—whichever your preference, Westinghouse quality provides better protection with either type. Switchgear apparatus engineers Rusty Campbell and Bob Lawrence explain why:"

New expulsion arrester will interrupt 20,000 amperes



With the new LX arrester you can protect your equipment at any place on your distribution system.

The short-circuit capacity of the new LX provides flexibility previously unobtainable in expulsion arresters. System fault current is no problem for this arrester. You can place it on your equipment in close to your substations where other expulsion arresters will not clear the power-follow current. This design will also clear small power-follow currents found on delta circuits or at the end of your long rural lines.

Industry standards state that the short-circuit rating must be placed on the nameplate of the arrester. Westinghouse has complied with this on the new LX as follows:

3 kv—20,000 amps
6 kv—16,000 amps
9 kv—12,000 amps
12 kv— 6,000 amps
15 kv— 3,000 amps
18 kv— 1,500 amps

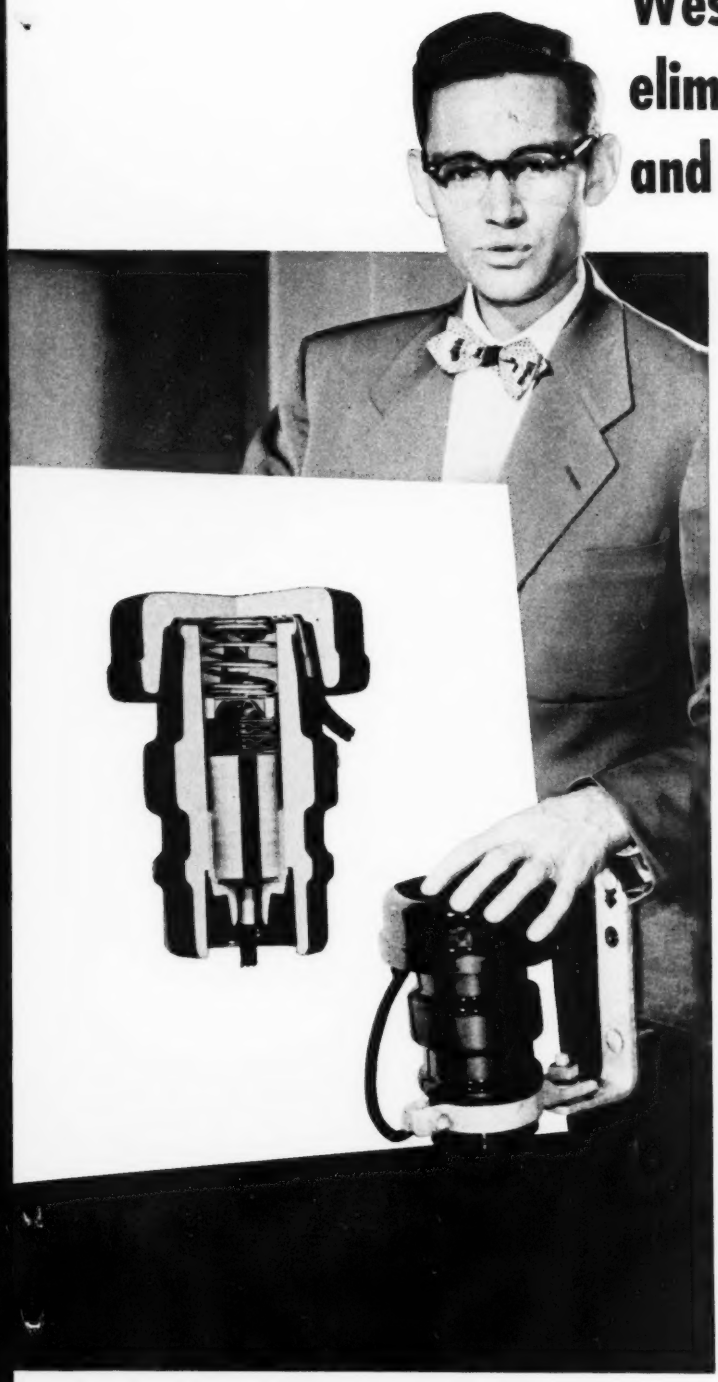
These high short-circuit capacities were achieved by the current-limiting action provided by the spiral interrupter. On small faults where not much help is given by expulsion action, the arc is cooled and interrupted by the long path it must travel.

This LX expulsion arrester provides excellent protection for your distribution equipment. It has low sparkover, and surge current capacity far exceeding industry standards. These, coupled with the power-follow current interrupting ability of the LX, give you an expulsion arrester that will meet your needs.

Westinghouse is sure this design will meet your most severe requirements for lightning protection. We suggest you place some of these at points where you previously have had lightning protection problems. Write now for more information on these arresters. J-60840

YOU CAN BE **SURE**...IF IT'S

Westinghouse valve arresters eliminate line lockout and moisture trouble



The dependability of Westinghouse valve arresters has been proved through 13 years of trouble-free service.

In the last 13 years, not one of the three common arrester troubles has been reported on Westinghouse LV arresters.

1. Not one case of line lockout.
2. Not one case of radio interference.
3. Not one case of moisture getting into the arrester.

The first valve arrester was manufactured by Westinghouse in 1922. From 1922 to 1940 five designs of this arrester were built, each an improvement on the preceding design.

In 1926 we introduced the dropout ground lead which prevents line lockout.

In 1931 we eliminated radio interference by the introduction of the only successful moisture seal found on distribution arresters today. A spun-on brass cap compresses a treated neoprene gasket to the ground porcelain body. After sealing, each arrester is pressure tested with nitrogen.

In 1931 we manufactured the first block valve element. Each block is surge tested and its characteristics checked on a cathode ray oscillograph at 1,500 amperes, 10-20 wave.

In 1935 we introduced the pre-ionizing principle. Metal tips are used in the spark gap which insure consistently low sparkover characteristics.

In 1940 we introduced the present LV arrester containing all of the desirable time-proved features of preceding valve designs. Plus—a larger valve element to handle long-tailed lightning (hot lightning strokes found on rural circuits). This design is being used today. Tests on each valve element insure that the arrester may be used anywhere on a distribution system.

Write for more information on this time-proved arrester. J-60841

Westinghouse

"Bob Rung of the Transformer Division gives a cost-saving answer to a transformer operating problem."*

New "PL" indicator provides automatic load check

As you know only too well, one of your big distribution system problems centers around distribution transformers. How can you tell when a transformer is seriously overloaded—before it causes you trouble and needless expense?

The new Westinghouse "Performance Log" indicator for conventional distribution transformers solves that problem in two practical ways.

First, it warns of an overload condition with a red signal light. For accuracy, the warning is based on the winding temperature . . . not oil temperature. The red light comes on during each of the first four overloads, and goes off when it has passed.

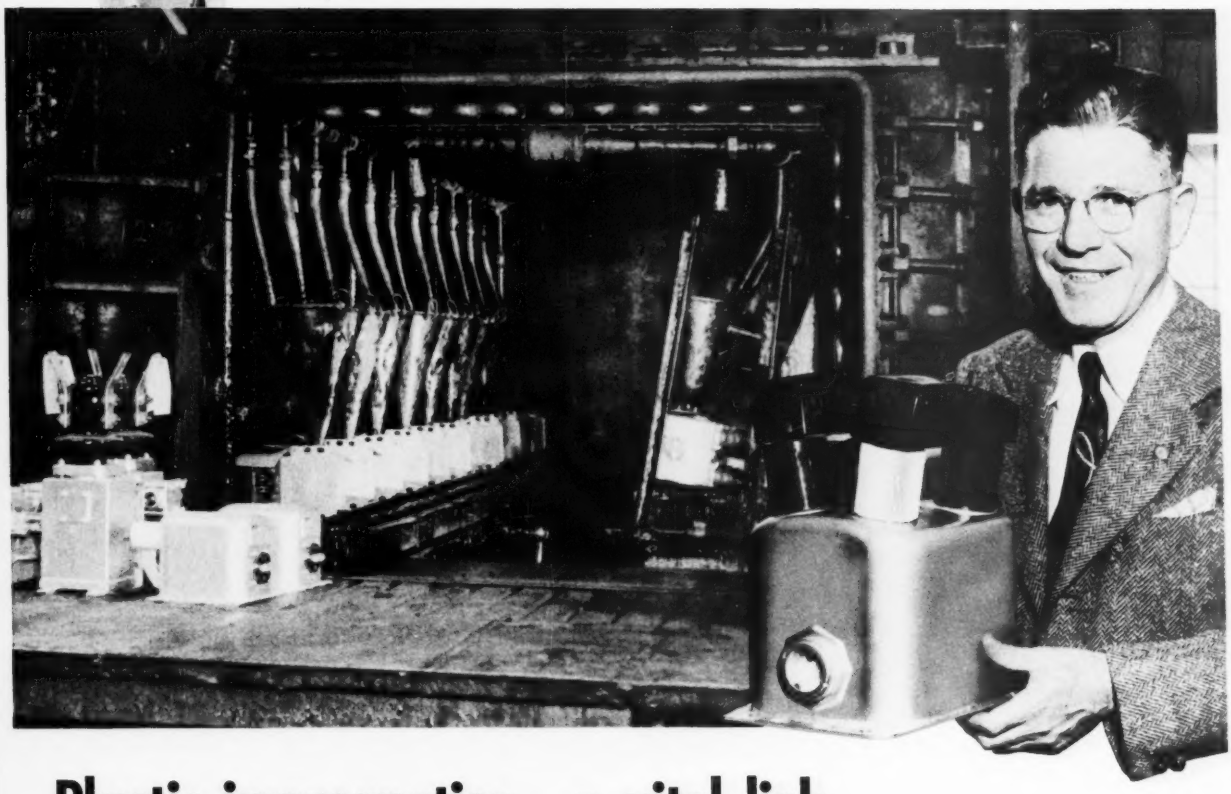
Second, a dial indicator, visible from ground level, records each overload. After five overloads, the red signal light comes on and stays on even after the overload has passed. The dial pointer, however, continues to record successive overloads. Expensive pole climbing and load checking are eliminated.

With this two-way protection on Westinghouse distribution transformers, you are kept constantly advised of transformer status . . . without expensive load checks . . . without inaccurate guesswork. Start now to plan for better protection of your distribution system by writing for TD-46-409. J-70700

*Manager, Distribution Equipment

YOU CAN BE **SURE**...IF IT'S

"John Chiles, Manager, Transformer Engineering, points out a strong factor in transformer reliability."



Plastic impregnation—a vital link to better distribution protection

The vital links in the control circuit of your metering and relay devices are potential and current transformers. As such, their reliability must be beyond question if you are to attain maximum protection of your distribution system.

One of the reasons for the high reliability of Westinghouse Types PT and CT instrument transformers is the process of vacuum impregnation in plastic pioneered by Westinghouse. A heat and vacuum treatment first removes every trace of moisture and air from both the plastic and the core-coil assembly. Then, under alternate vacuum and pressure, the plastic is forced into the innermost coils until all voids are filled. With moisture and air completely excluded and no possibility of internal corona, you can count on a continuing, reliable, control source . . . without costly maintenance under any weather or temperature extremes.

Plastic impregnation with such plus features as oxygen-free copper, Hipersil® cores, and sturdy steel cases provides good practical reasons why you can plan now for better protection of your distribution system.

Your Westinghouse representative can tell you much more about these important "links" to better protection. Why not call him—or write for CS-45-340 and CS-45-520. J-70701

Westinghouse

"Here's important news about cutouts from H. H. Fahnoe, Manager, Switchgear Distribution Apparatus Engineering . . ."

Now — maximum flexibility achieved with Westinghouse cutouts

With *one* porcelain box, it is now possible to obtain the three most popular cutout ratings:

1. The standard 50-amp, 1200-amp I.C. cutout known as the Westinghouse EA 50.
2. Our HC-50 cutout—high capacity 50-amp, 5000-8000-amp I.C.
3. The new MC-100 cutout which gives you a 100-amp cutout with 5000-8000-amp I.C.

This exclusive feature allows you to start out with a low-priced standard 50-amp cutout—then by merely changing the door you have a 50-amp or 100-amp cutout with greater interrupting capacity. *One porcelain box—three cutouts.*

There are actually seven interchangeable doors used with the standard box. Both a dropout and non-dropout design are available in each of the above three ratings—making a total of six—plus a 100-amp disconnect blade.

Picture shows 5.2-kv cutouts. Equivalent ratings are available for 7.8-kv service. This complete interchangeable line enables you to make big reductions in your inventories because only the doors need be stocked, not the boxes.

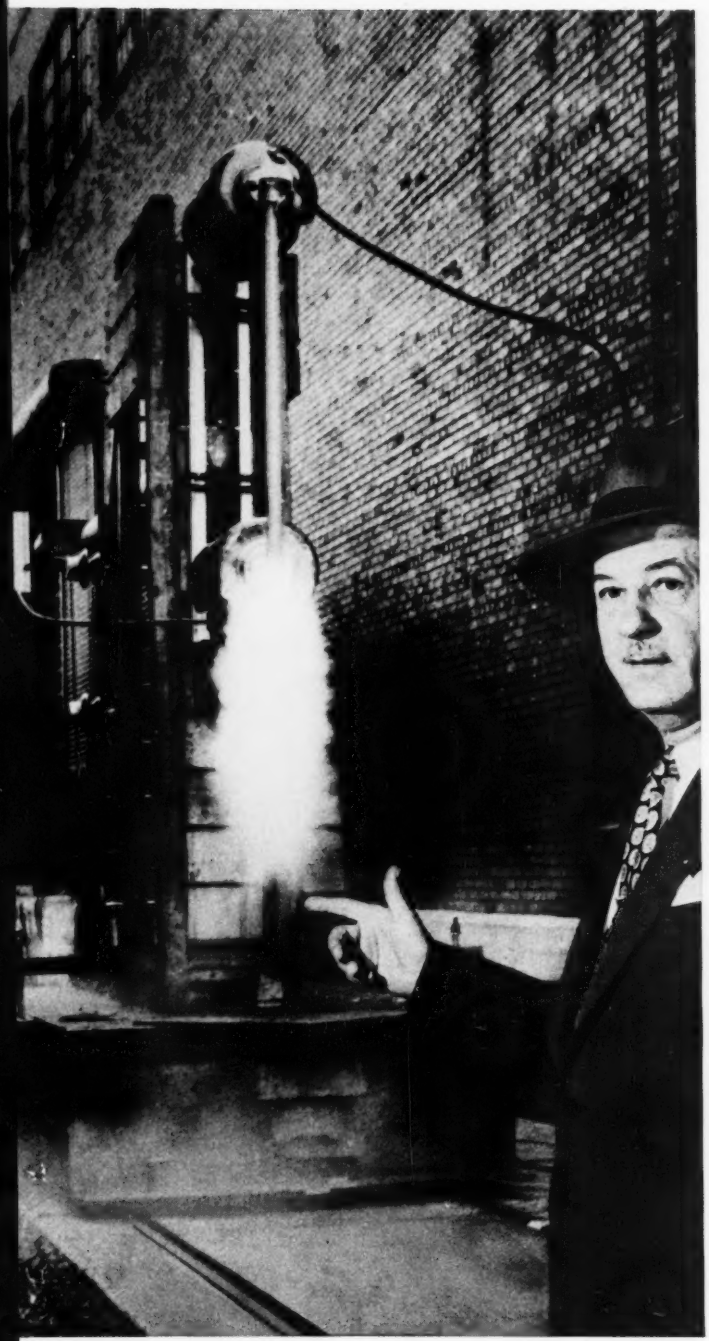
All these cutouts have the important Westinghouse features. You know all the doors will fit because the boxes are made by the exclusive Prestite® porcelain process. It combines the high dimensional accuracy of dry-process porcelain with the high strength of the wet-process.

For those who prefer the dropout design, we offer an exclusive feature—180° dropout for greater safety and visibility. The door is easily removed and replaced with a hook or switch stick for complete safety.

Write for D.B. 38-610 for more information on this outstanding complete cutout line. J-60839

YOU CAN BE **SURE**...IF IT'S

"Wilbur Pyle* explains why we know, and you know, that Westinghouse power fuses give you the level of protection promised on the label."



Every new power fuse development proved under actual fault conditions

Improvements are constantly being made in boric acid power fuses—originally developed by Westinghouse 20 years ago. This, of course, makes for better fuses but it also poses a problem: How do we *know* the new design will have the proper characteristics, the right interrupting rating?

We answer this important question by taking hundreds of new fuses into the High Power Laboratory and *proving* them under actual fault conditions. We test at high currents, low currents, high voltage, low voltage (sometimes, paradoxically, a model will interrupt at high voltage but not at low).

This takes a restraint off our fuse designers and you. There's no tendency to freeze on a design just because its ratings are proved. *We* can prove the new one, without bothersome field testing by you.

Here are some of the recent improvements this procedure has engendered. We now paint the outside of extra-high-voltage DBA Fuses with Coronox®, a *conducting* paint that shields. Coronox helps reduce corona, prevents flashover and improves electrostatic properties.

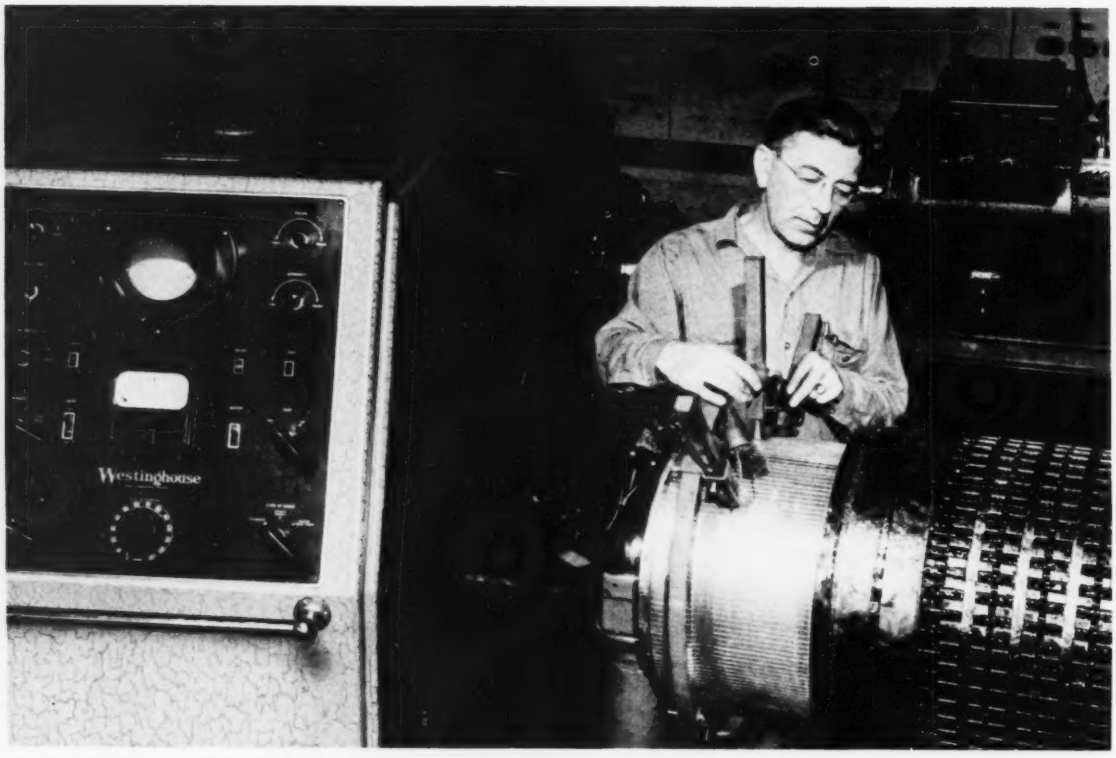
Parts inside of the fuse tubes, where practical, are now painted with silicone varnish which reduces corrosion. We now use *triple* separable contacts with individual pressure springs which do a better job than the contact construction formerly used.

Write us now for more information on these *proved* power fuses. J-60842

**Manager, Switchgear Devices Section*

Westinghouse

"Here's an apparatus repair service that has a vital effect on utility operations . . ."



Serving electric utilities . . .

a nationwide system of specially equipped repair shops

Within easy reach of your company is a modern, well-equipped repair plant—ready to repair, rebuild or modernize any type of your electrical equipment. It is one of the 38 repair plants which Westinghouse owns and operates throughout the country.

The surge comparison tester shown in the picture above is only one example of the complete facilities which are available in these repair shops for testing powerhouse motors and other equipment. Each plant is so equipped to give you the kind of repair job that is your best guarantee of dependability and high service continuity.

When a piece of equipment is sent to us for repair, we'll send it back as good as, *or better than,* new. Westinghouse research engineers are constantly developing improved materials and modernization features that are applied to our repair and rebuilding processes. For example, with our replacement core and coil assemblies, distribution transformers can usually be given a higher than original kva rating.

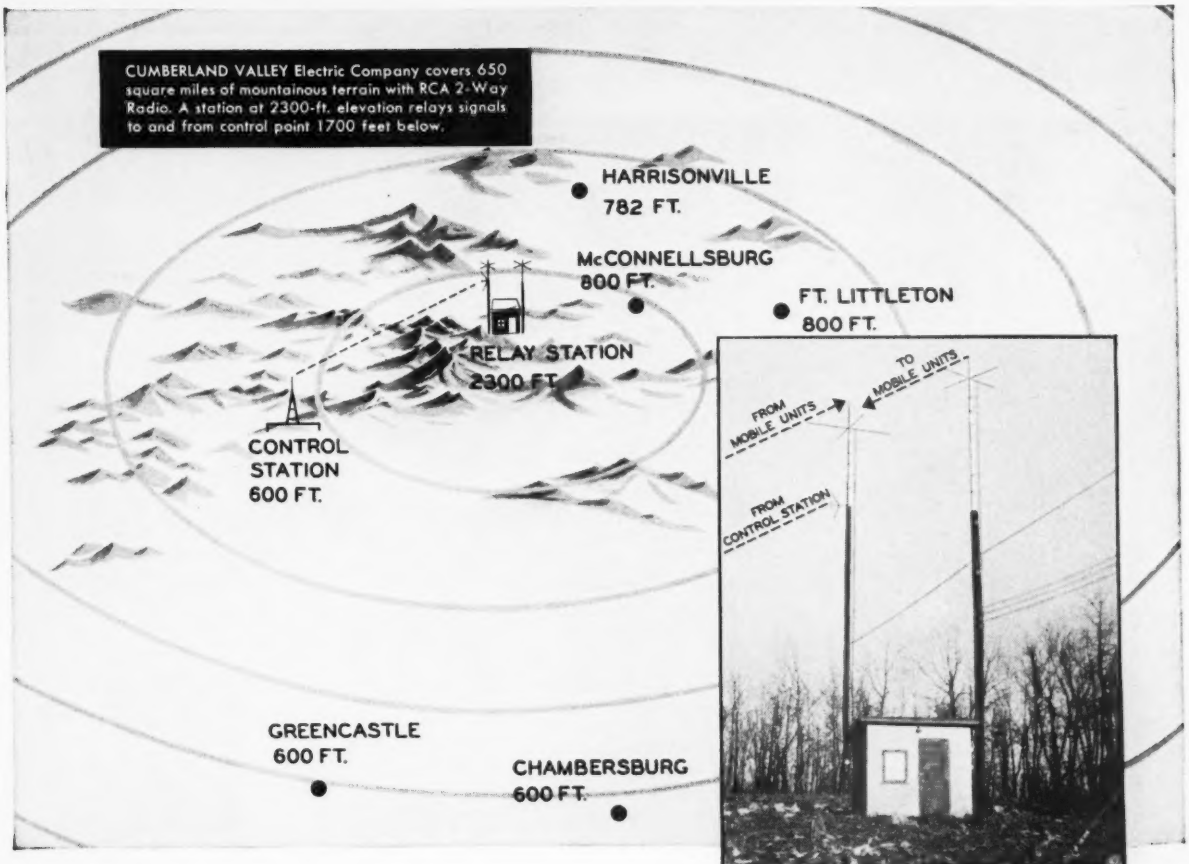
The work in our repair plants is highly organized. Each job receives specialized attention with standardized techniques and repair processes and is subject to rigid quality control checks at various stages of job completion. This assures not only the highest quality repairs, but also fast, efficient handling which enables us to give prompt service.

★ ★ ★ ★ ★ ★

Write us for more information on this important service to the electrical industry, or on any of the products discussed on preceding pages. Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. CP-2(1010)

YOU CAN BE **SURE**... IF IT'S

Westinghouse



HILLTOP RELAY STATION receives signals from control station on 73.98 mc. and from mobile units on 48.54 mc. Station transmits on 37.58 mc.

RCA 2-Way Radio raises Cumberland Valley 1700 feet

VHF radio relay has recently converted a difficult piece of terrain into ideal radio territory for Cumberland Valley Electric Company, of Mercersburg, Pennsylvania.

Working with RCA communications men, Cumberland Valley engineers virtually lifted the utility's headquarters from its valley site, and placed it on a hilltop seven miles away. From this vantage point the company achieves unusual efficiency, over its 650 square-mile service area.

In addition, the installation permits twenty-four-hour communication between mobile units without requiring a twenty-four-hour dispatcher. Superior car-to-car communication, provided by the hilltop relay, keeps crews in direct contact with each other during dispatcher's off-duty hours.

For engineering assistance on difficult communications problems, contact the RCA Communications Specialist at your local RCA Regional Office. For day-in, day-out dependability, specify RCA 2-Way Radio. For Literature... clip coupon below, and mail it today.

RCA®

RADIO CORPORATION of AMERICA
COMMUNICATIONS EQUIPMENT CAMDEN, N. J.

Radio Corporation of America
Communications Equipment, Dept. 15VC
Building 15-1, Camden, New Jersey

☐ Please send me information on RCA 2-Way Radio.

☐ Please have an RCA Communications Specialist call on me.

Name_____ Title_____

Company_____ Address_____

City_____ Zone_____ State_____

View of the 100,000 kw Westinghouse turbine in the Acme Station of the Toledo Edison Company. In addition to this turbine, a 60,000 kw General Electric turbine and a 50,000 kw Westinghouse turbine are also lubricated with Gulfcrest Oil.

GULFCREST is the RIGHT oil for every steam turbine

the RIGHT base stock, Alchlor-processed

the RIGHT combination and concentration of additives

the RIGHT background of performance

Gulfcrest Oil has a background of successful performance in every type and make of steam turbo-generator.

In many of these installations the original charge of Gulfcrest has been in service more than 10 years with no significant change in its original characteristics, and with neutralization numbers always remarkably low and safe.

To get this kind of lubrication for your turbine, call in a Gulf Sales Engineer and ask him to recommend the proper grade of this superior oil. Write, wire, or phone your nearest Gulf office today.

Gulf Oil Corporation · Gulf Refining Company

Pittsburgh 30, Pennsylvania

GULF SERVES INDUSTRY

Vacuum dried, oil impregnated crepe paper

NOW IN PRODUCTION AT IRVINGTON!

Your requirements for crepe paper insulation can now be supplied by Irvington — the *leader* in electrical insulation.

Crepe paper and oil are degasified under very high vacuum to assure freedom from moisture and provide good electrical properties.

The paper is packaged in cans to meet your specific requirements for number and size of rolls. Roll sizes include ½" x 4 yards, 1" x 4 yards, 1" x 18 yards, 1" x 36 yards. Cotton yarn and copper mesh can also be included.

Use Irvington Crepe Paper on your low- and medium-pressure gas-filled cable — and also on oil-filled and pipe-type cable.

Look to
IRVINGTON
for Insulation Leadership

INSULATING VARNISHES
VARNISHED CAMBRIC
VARNISHED PAPER
VARNISHED FIBERGLAS
INSULATING TUBING
CLASS "H" INSULATION

Other IRVINGTON Insulations for Utilities

Harvel Oil Stop 621 • Fibron® Plastic Tape • Temflex® 105 Tape • No. 32 Red Enamel

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VARNISH & INSULATOR COMPANY

21 Argyle Terrace, Irvington 11, New Jersey

Plants: Irvington, N. J.; Monrovia, Calif.; Hamilton, Ontario, Canada

Irvington Varnish & Insulator Company EW10/53
21 Argyle Terrace, Irvington 11, N. J.

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☐ the following products_____

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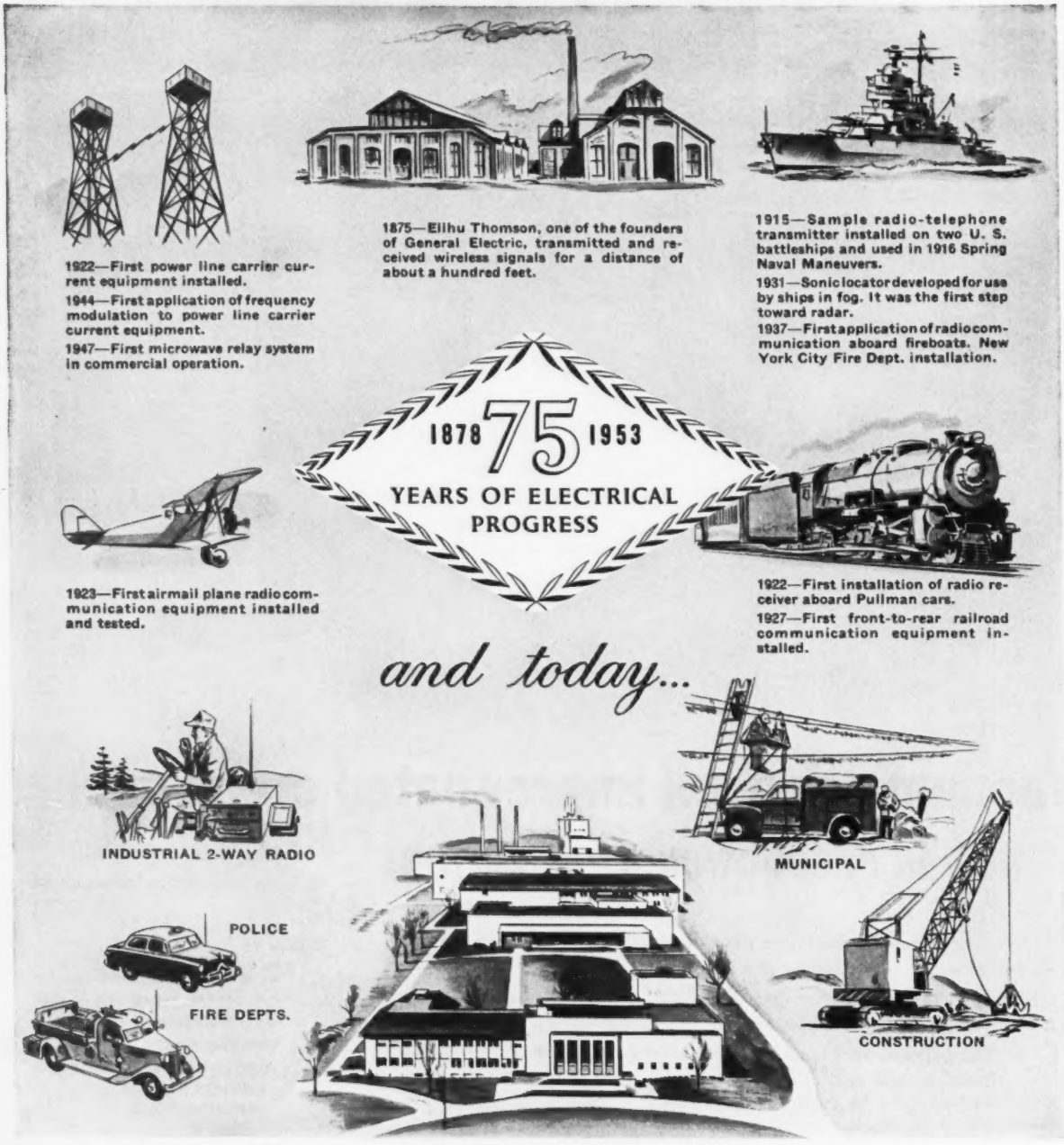
Company_____

Street_____

City_____ Zone____ State_____


1922—First power line carrier current equipment installed.
1944—First application of frequency modulation to power line carrier current equipment.
1947—First microwave relay system in commercial operation.
1875—Elihu Thomson, one of the founders of General Electric, transmitted and received wireless signals for a distance of about a hundred feet.
1915—Sample radio-telephone transmitter installed on two U. S. battleships and used in 1916 Spring Naval Maneuvers.
1931—Sonic locator developed for use by ships in fog. It was the first step toward radar.
1937—First application of radio communication aboard fireboats. New York City Fire Dept. installation.
1878 75 1953
YEARS OF ELECTRICAL PROGRESS
1923—First airmail plane radio communication equipment installed and tested.
1922—First installation of radio receiver aboard Pullman cars.
1927—First front-to-rear railroad communication equipment installed.
and today...
INDUSTRIAL 2-WAY RADIO
MUNICIPAL
POLICE
FIRE DEPTS.
CONSTRUCTION

Matchless Heritage IN COMMUNICATIONS ENGINEERING

From the several companies formed to manufacture Edison's historic electric lamp, G.E. is today a company with 200,000 products . . . engaged in 13 of the 21 basic manufacturing industries. Its tremendous human and material resources are constantly working to give you a better life with new and improved products.

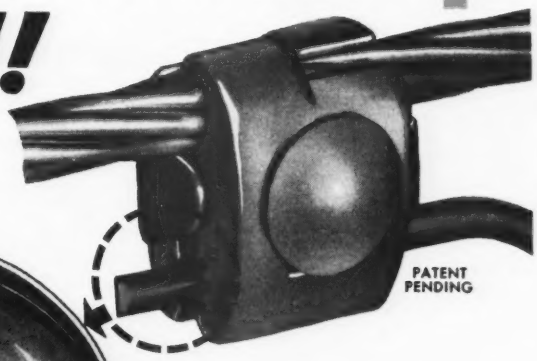
Communications in your business is the outgrowth of many G-E "firsts." Today — using G.E.'s *high-performance, low maintenance* radio units—industry, utilities, and municipal government reap these benefits: instant reliable communication for increased productivity . . . area control . . . citizen protection.

For information write: *General Electric Company, Section 19103-19, Electronics Park, Syracuse, New York.*

GENERAL ELECTRIC

REVOLUTIONARY NEW DESIGN of ALUM-COPPER Parallel Groove Clamp!

by BLACKBURN!



NEWLY DEVELOPED PROCESS . . . eliminates use of solder in attaching copper liner to cast aluminum body — no moisture trapping voids or corrosive fluxes between liner and body to foster galvanic corrosion.

COPPER LINER PERMANENTLY LOCKED IN — SEALS OUT MOISTURE!

Aluminum body is pressure cast around the pronged copper liner. Because the aluminum body has a greater coefficient of contraction than the pronged copper liner, it exerts great clamping forces against the prongs as the molten aluminum solidifies. This air-tight shrink-fit permanently seals out moisture.

Operating temperatures under the most severe conditions never approach the heat of the aluminum in its molten state, therefore high clamping forces against the pronged liner are retained . . . liner cannot come loose.

HIGH CONDUCTIVITY

Special surface treatment of the under side of the copper liner reduces surface tension of the molten aluminum. This establishes an intimate low-resistant contact between the two metals.

STRONG — CORROSION RESISTANT

Aluminum bodies are cast of a special alloy, selected for its high corrosion resistance. This alloy is exceptional in that it also combines high strength with ductility. Steel bolt, nut and lock washer are hot dipped galvanized.

SIMPLIFIES STOCKING PROBLEMS

One clamp covers a wide range of popular conductor sizes.

ORDERING INFORMATION

	Copper	Aluminum
PAC 6/0	8 AWG to 2 stranded	6 ACSR to 1/0 ACSR

Mail Coupon Below for FREE Sample — or — Order TODAY!

JASPER BLACKBURN CORPORATION
35 Madison St. — St. Louis 6, Mo.
Phone CEntral 3007

BLACKBURN *Parallel Groove* **CLAMPS**

FREE SAMPLE-MAIL TODAY

JASPER BLACKBURN CORPORATION
35 Madison St., St. Louis 6, Mo.

Send FREE Sample of New ALUM-COPPER Parallel Groove Clamp.

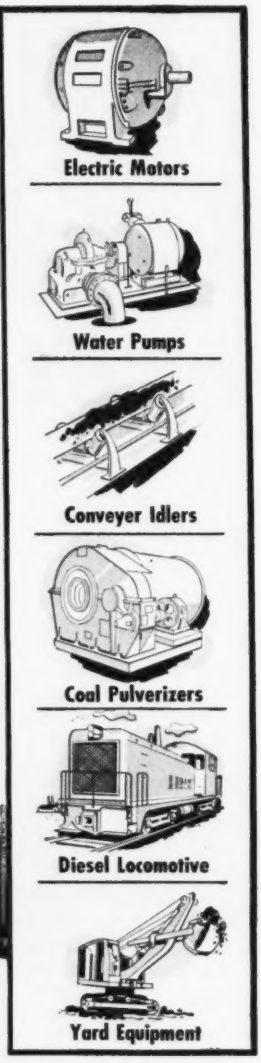
Your Name and Title.....

Firm.....

Address.....

City and State.....

"Indianapolis Power & Light Company's large new White River plant uses Shell Alvania Grease on every one of these grease applications!"



Check the multiple qualities of this remarkable lubricant

Shell Alvania Grease is effecting important improvements in plant maintenance and purchasing practice. In plant after plant, this one grease is replacing the many special purpose greases formerly used . . . for *every grease application in the plant!*

Look at these advantages:

1. Shell Alvania Grease flows *freely* in cold temperatures, yet will not run out of bearings under excessive heat.

2. Ideal for wet, humid applications . . . it resists water emulsification.

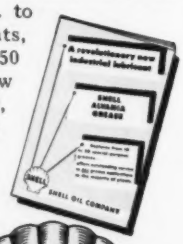
3. Shell Alvania Grease has extremely high oxidation stability.

4. You'll find that Shell Alvania Grease extends time between greasings . . . a substantial saving in labor and grease.

5. Simple inventory . . . just the one grease to stock and apply.

• • •

The economy of handling just one grease instead of *many* is an established fact. Write for the new booklet on Shell Alvania Grease . . . to Industrial Lubricants, Shell Oil Company, 50 West 50th Street, New York 20, N. Y.—or, 100 Bush Street, San Francisco 6, Calif.



SHELL ALVANIA GREASE

The True Multi-Purpose Industrial Grease

SHELL

KEEP YOUR POWER LOAD UP ...YOUR OUTAGES DOWN!

String Copperweld TRADE MARK

OVERHEAD GROUND WIRES

—and get PERMANENT PROTECTION for your Transmission Lines

Every year an average of 70,000 strokes of lightning hit power lines in this country, causing 10 times as many transmission outages as any other single factor. As a practical, economical solution to this serious problem, many power systems are using Copperweld* Overhead Ground Wires on their transmission lines to be sure of safe, low-cost and permanent protection against lightning damage.

Copperweld's thick copper covering, inseparably molten welded to the strong steel core of each wire, affords excellent electrical conductivity for relaying and for dissipating lightning discharges. And because this copper covering is rust resistant, the high strength of each wire remains permanent. Thus, with Copperweld Overhead Ground Wires, you can string with small sags to maintain ample mid-span clearances—even under the most severe weather conditions.

Plan now to shield your transmission lines with Copperweld Overhead Ground Wires. You'll find there's no better way to reduce lightning losses, keep upkeep down and be assured of constant uninterrupted service. Write today for your copy of the Copperweld Engineering Data Book—there's no obligation.

*Trade Mark

COPPERWELD STEEL COMPANY • Glassport, Pa.

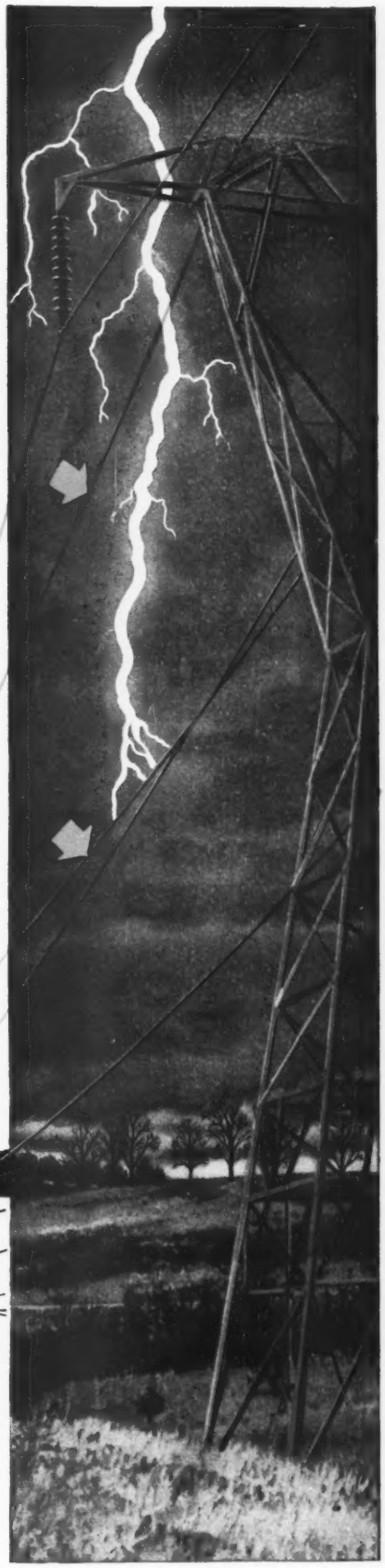
SALES OFFICES IN PRINCIPAL CITIES

Copperweld TRADE MARK

NON-RUSTING

OVERHEAD GROUND WIRES

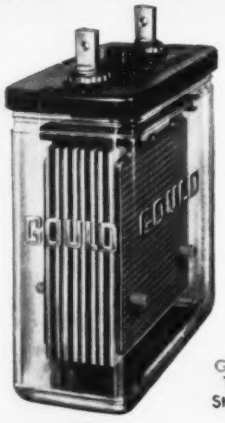
Last The Life Of The Conductors They Protect!



UNMATCHED DEPENDABILITY

THANKS TO BATTERY POWER!

Racks of Gould Planté Batteries are a satisfying sight! You can be sure of complete protection against any emergency today, tomorrow or years from now. Because Planté positive plates are PURE LEAD, required float current is minimized, service life is increased and per annum cost is lowered. Only with this Aristocrat of Stationary Batteries can you get standby power that's unequalled for faithful service . . . year after year dependability.



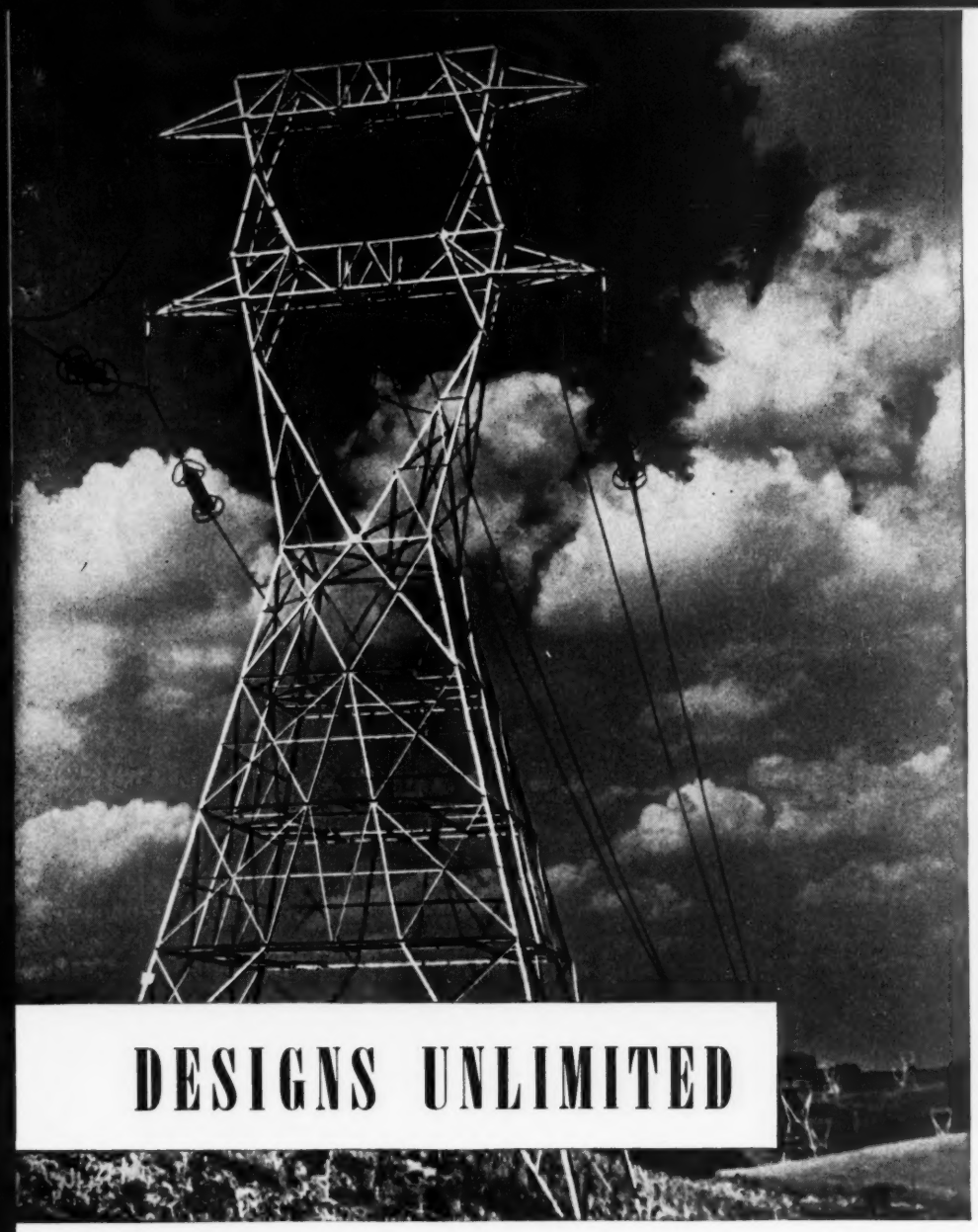
Specify
GOULD PLANTÉ—
The Aristocrat of
Stationary Batteries

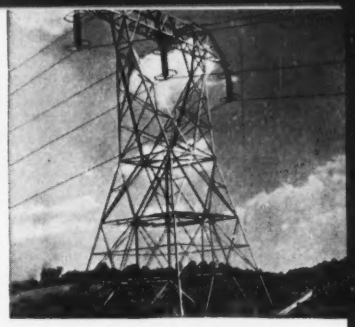
GOULD INDUSTRIAL BATTERIES

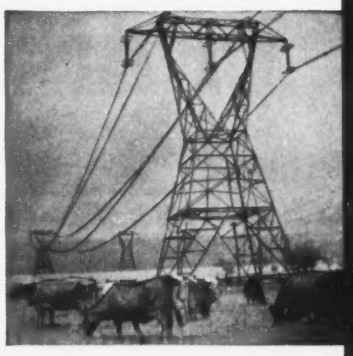
GOULD-NATIONAL BATTERIES, INC., TRENTON 7, N. J.

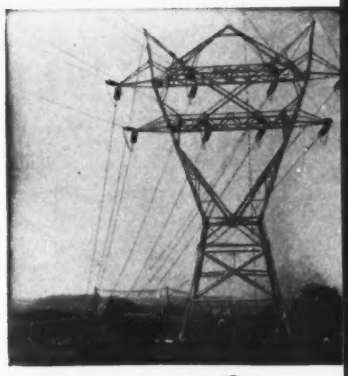
Always Use Gould-National Automobile and Truck Batteries

©Gould-National Batteries, Inc.









DESIGNS UNLIMITED

If your engineers have their own ideas on tower design, well and good. We will follow them to the letter and adhere closely to specifications. Your engineers realize, as we do, that despite general similarity no two towers are alike. Each tower must be designed for its particular location and purpose.

Let us apply our four decades of experience in building towers for any and all conditions of terrain and load to your power transmission problems.

BLAW-KNOX COMPANY
BLAW-KNOX EQUIPMENT DIVISION
PITTSBURGH 22,
PENNSYLVANIA

BLAW-KNOX

ANNOUNCING...

SCHIELD Bantam's® BRAND NEW All New

CRANE CARRIER

For use with the Model T-35 BANTAM... the latest development in shovel-cranes.

LIFTS 12,000 LBS.!

LOW PRICED ONLY

$12,750

Complete, as Illustrated F.O.B. Factory

Lower price if Crane Carrier Extras such as double out-riggers and fenders not desired. (Price subject to change)

This brand new Crane Carrier, exclusively engineered for BANTAM mounting by a leading and famous truck manufacturer, answers the demand for all-new truck crane equipment with high-speed mobility. It's built right — and priced right!

This, too, is ALL NEW!

The Great C-35

CRAWLER

5-ton . . . ⅜ cu. yd.

Yours for only

$10,330

Complete Crawler Back Hoe with 30" bucket, f.o.b. Factory. (Price Subject to Change)

Now . . . BANTAM Offers Any Type of Mounting You Want

The versatile, job-proved BANTAM which has established enviable records of economy on all kinds of lifting and excavating jobs everywhere is now available with a wide choice of mountings, letting you select the best suited combination to handle your jobs faster and at far less cost.

Today, you can get a BANTAM with a brand new, all-new Crane Carrier as illustrated . . . or mounted on a factory guaranteed re-built truck. Or, to save yourself more money, a BANTAM can be field-mounted on YOUR TRUCK.

But, that's not all! Then, to meet your needs for a top quality, low-priced ⅜-yard crawler shovel-crane, Schield BANTAM now offers the new Model C-35 . . . it's the revolutionary crawler everyone's talking about! And, best of all — no matter which type of mounting your work calls for, the complete BANTAM with any one of 9 fast-change front-end attachments is still the lowest priced, ⅜-yard, 6-ton shovel-crane on the market.

Investigate the BANTAM method . . . find out how a BANTAM lets you bid lower and get more work. Ask for a free demonstration on your job. See your nearest Schield BANTAM Distributor or contact the factory, TODAY!

SCHIELD BANTAM CO.
287 Park St., Waverly, Iowa

T-35 with Crane Carrier for fast job-to-job moves

T-35 BANTAM mounts on factory re-built 6 x 6 or on Your Truck.

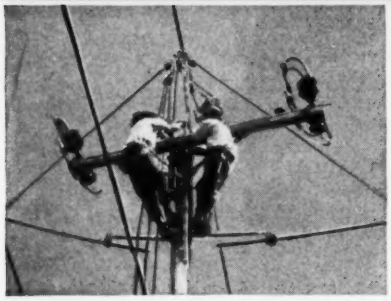
ANOTHER NEW PRODUCT OF THE SCHIELD Bantam Co.

WORLD'S LARGEST PRODUCERS OF TRUCK-CRANES AND EXCAVATORS

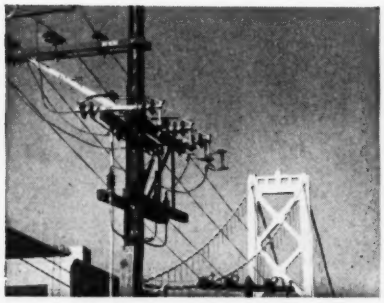
KPF

AIR BREAK SWITCHES

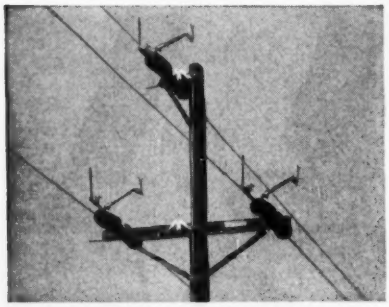
Standard for nearly half a century



Installing KPF Type A-202 switch hot on 12 kv line. KPF phase units are shipped completely assembled, ready for quick installation.

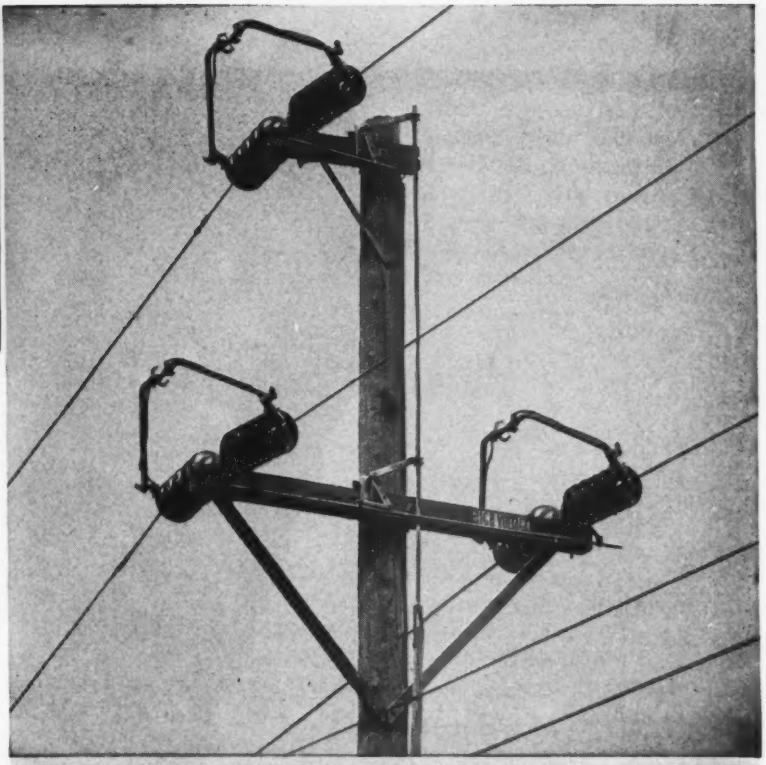


Horizontal-mounted KPF Type UF-2 switch in metropolitan service (P.G.&E., San Francisco). Versatile KPF switches operate equally well with or without line tension.



KPF Type S-205 switches with inexpensive Quick-Break attachment on 60 kv rural transmission line. Switch shown in open position.

2825



Basically different switch design proven in decades of service with leading utilities

Service-proved KPF switches look different because they *are* different.

Their simple, sturdy design insures freedom from mechanical failure or lubrication worries, and virtually eliminates maintenance. Self-aligning silver surfaced blades operate smoothly despite severe ice or crossarm warpage conditions. Installation is fast and economical—switches are bolted directly to crossarms on the ground or in the air. No separate strain insulators or extra crossarms are required; integral insulator stacks readily adjust to line sag.

KPF switches have been used for almost 50 years on lines ranging from 7.5 to 110 kv. Tens of thousands are in use today by Pacific Gas & Electric, Southern California Edison, Minnesota Power & Light and other leading power companies throughout the world.

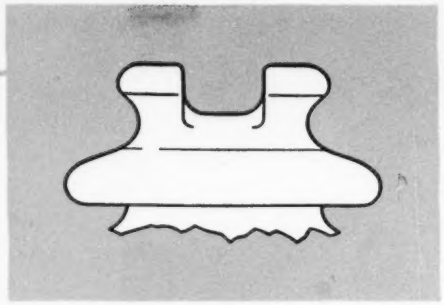
For the world's simplest, surest, lowest cost air break switch, specify KPF—standard for nearly 50 years.

New catalog gives complete specifications, detail drawings, installation information.

KPF ELECTRIC COMPANY

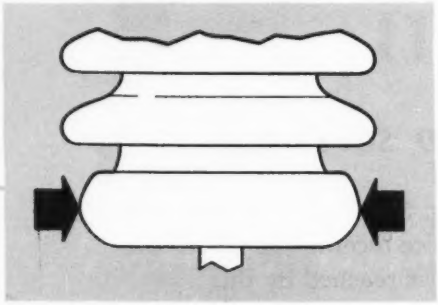
1624 East Alpine Avenue, Dept. E-1, Stockton 5, California

Lapp LINE POST



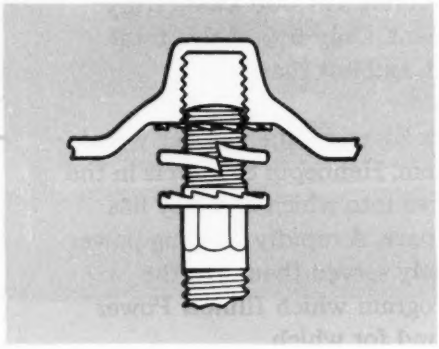
LARGER CONDUCTOR GROOVES

Improved wider square-side top-grooves—conforming to new EEI-NEMA standards—provides for conductor of any diameter up to 1½″. Holds conductor in top groove turning angles up to 15° (30° by using two insulators). With 45-Kv and smaller Line Posts, sharper angles may be turned by using side groove for conductor.



HARDWARE EXTERNALLY ATTACHED

Porcelain is approximately five times as strong in compression as in tension. In the Lapp Post design there are no nested porcelain parts or metal inserts which can load the porcelain in tension—or with any high-intensity local stresses. Hardware attachment is a cemented-on base, providing the safety of a large area, low-intensity compression grip.



INTERCHANGEABLE STUD BOLTS

Stocking problems are reduced with the Lapp Line Post. Separable 7″ (for wood cross arms) or 1¾″ (for metal mounting) studs—or special lengths on order—are interchangeable for all units, and may be installed in the field. Serrated surfaces in the base and stud flange engage a "positive" lock washer—when the stud is tightened into the base a vibration-proof attachment is assured.

LAPP INSULATOR CO., INC., LE ROY, N.Y.

NEW UTILITY STATIONS C-E EQUIPPED

Includes stations placed in operation since the war (in white) and those under construction or being engineered.

TIDD • JENNISON
CECIL LYNCH • HAVANA
MEREDOSIA • PERMIAN BASIN
O. H. HUTCHINGS • REX BROWN
HICKLING • B. C. COBB
RUSSELL • SEWAREN
POSSUM POINT • CUTLER
PORT JEFFERSON • WHITE RIVER
POTOMAC RIVER • GADSDEN
W. SPRINGFIELD • WOOD RIVER
DAN RIVER • LAKE CATHERINE
HARRY NEWMAN • JIM HILL
HUTCHISON • YATES
DUNKIRK • TITUS • LEE
CONTRA COSTA • HAWTHORN
NINEMILE POINT • EDGE MOOR
PALATKA • JOHNSONVILLE
DANSKAMMER • BECKJORD
HIGHGROVE • PLANT X
BLACK DOG • ALBANY
JOPPA • MERAMEC
PORTSMOUTH • LAKE CREEK
ETIWANDA • AURORA

HENNEPIN

EASTLAKE
OAK CREEK
MULLERGREN
URQUHART
MILLIKEN
SAGUARO
SUWANNEE RIVER
SANDOW
NORTH OMAHA
NELSON
KINGSTON
WILMINGTON
BARRY
JOHN SEVIER
VERMILION
GALLATIN
ISLAND PARK
CARBON

New Hennepin Station

. . . *goes into service*

When the new Hennepin Station of the Illinois Power Company went into service recently an important and unusual milestone was reached by this progressive utility company.

No longer ago than 1947 Illinois Power's generating capacity totalled 37,000 kw. With the addition this past June of a new 75,000 kw unit at Hennepin, the system capacity now totals 519,000 kw—a truly remarkable accomplishment. Only 6% of this total is more than six years old, and less than half is more than four years old.

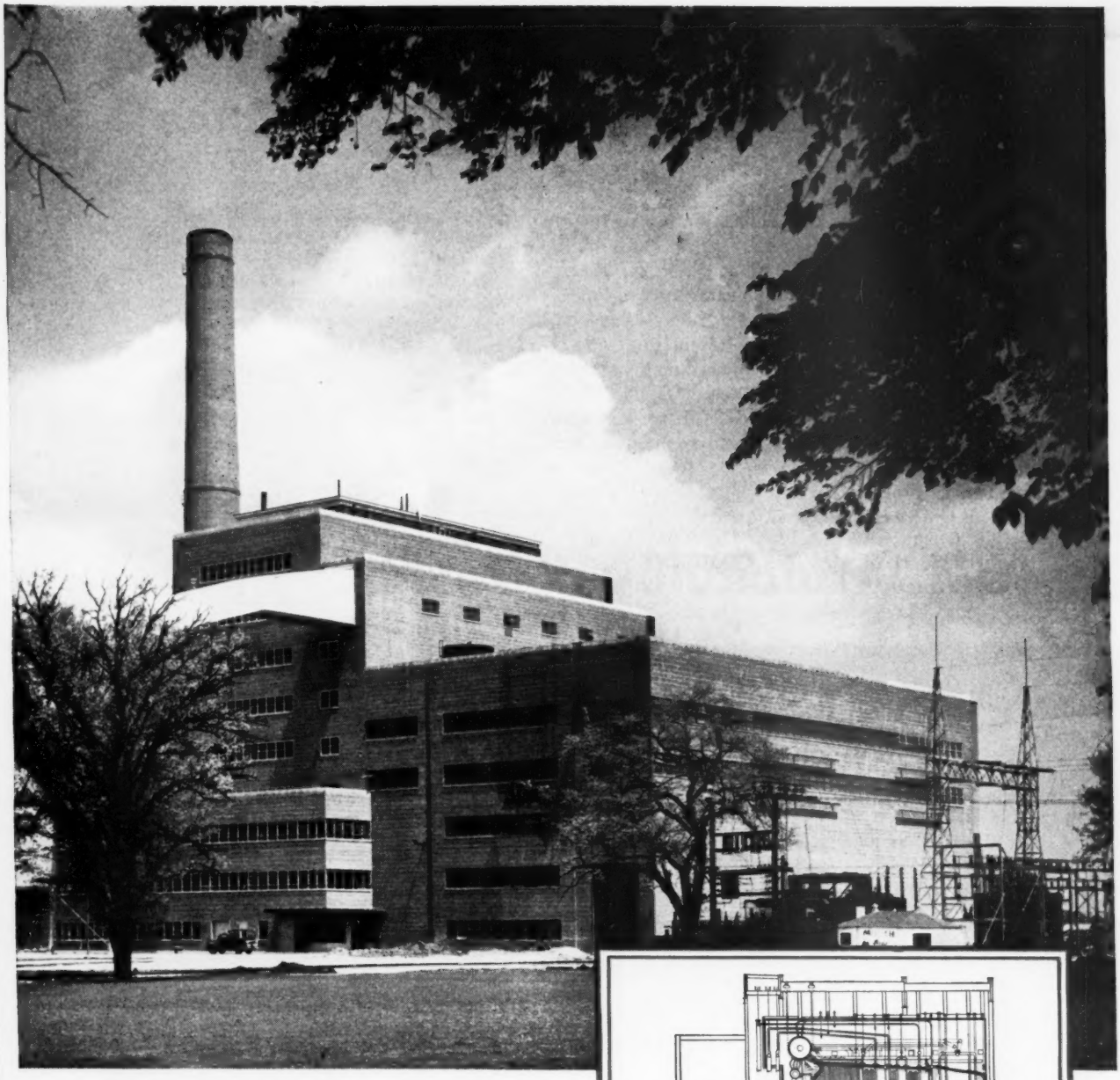
Located on the Illinois River on the northerly end of the Illinois Power system, Hennepin Station is in the heart of a rich farming area into which industry has been moving at a steady pace. A rapidly growing power demand is being adequately served thanks to the exceptional expansion program which Illinois Power Company has achieved, and for which Sargent & Lundy are the Consulting Engineers.

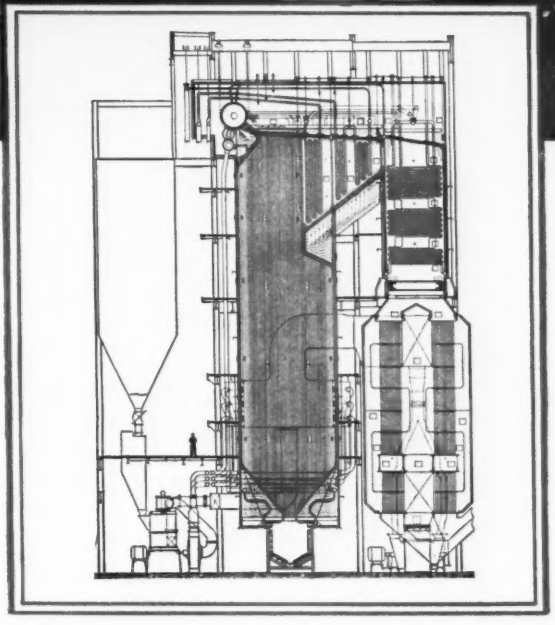
The new turbine generator at Hennepin is served by a C-E Radiant Reheat Boiler, a cross sectional elevation and brief description of which appear on the opposite page.

C-E

COMBUSTION

Combustion Engineering Building
200 Madison Avenue, New York 16, N. Y.





The cross-sectional view at the right shows the C-E Unit recently placed in service at the Hennepin Station of the Illinois Power Company. It is a radiant, reheat boiler with the reheater section located between the primary and secondary superheater surfaces. An economizer section is located below the rear superheater section and tubular air heater surface follows the economizer. The unit is pulverized coal fired employing bowl mills and tilting, tangential burners. It is arranged to use natural gas or oil as alternate fuels. Throttle pressure is 1450 psi at a primary steam temperature of 1005 F, reheated to 1005 F.

ENGINEERING

ALL TYPES OF STEAM GENERATING, FUEL BURNING AND RELATED EQUIPMENT

B-692

CORROSION... *Tough Utility Problem*

HARPER FASTENINGS... *Simple solution*

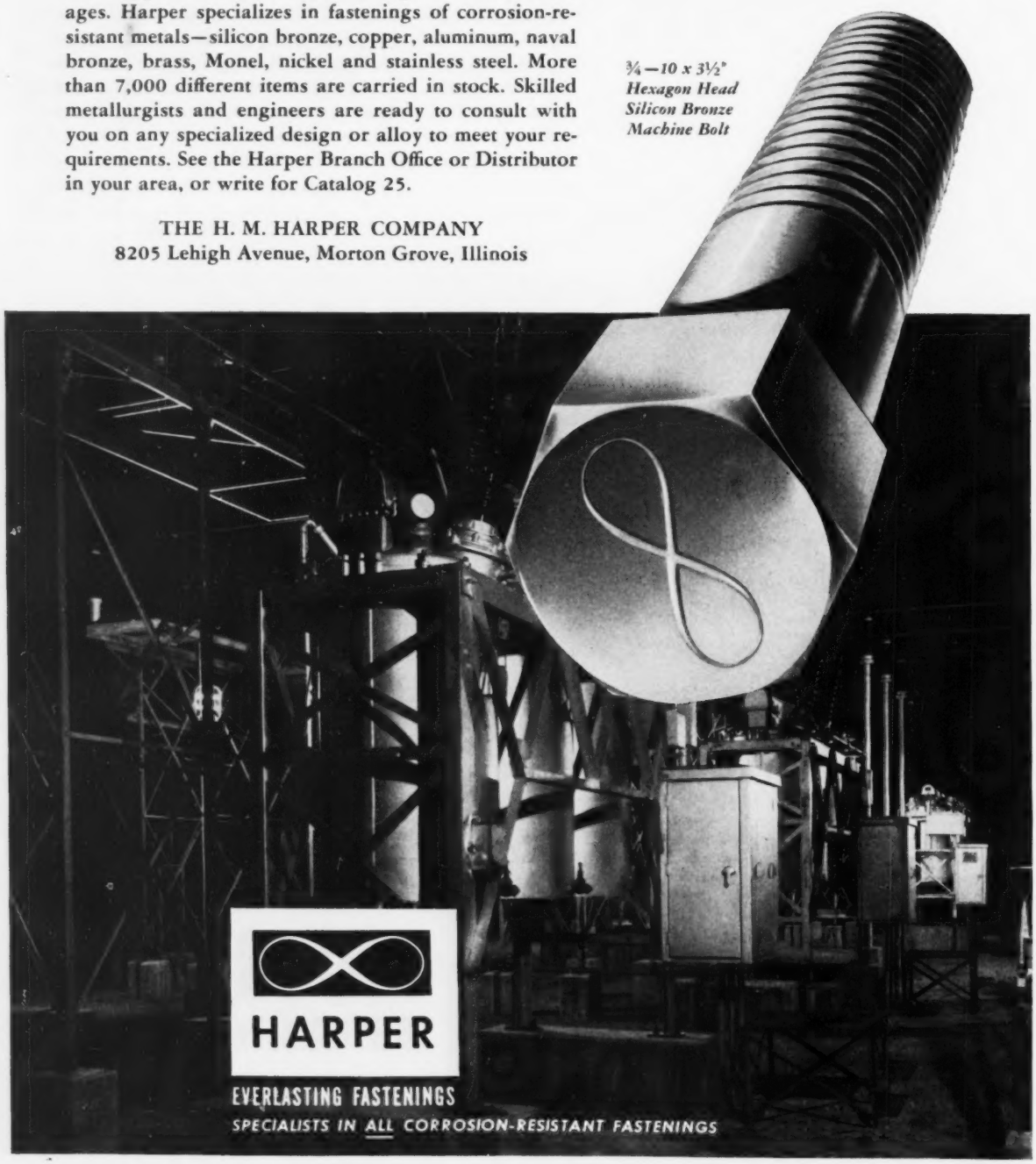
From turbine to transformer—substation to distribution line—all electrical equipment is subject to corrosion, the day-after-day menace to dependable electric service.

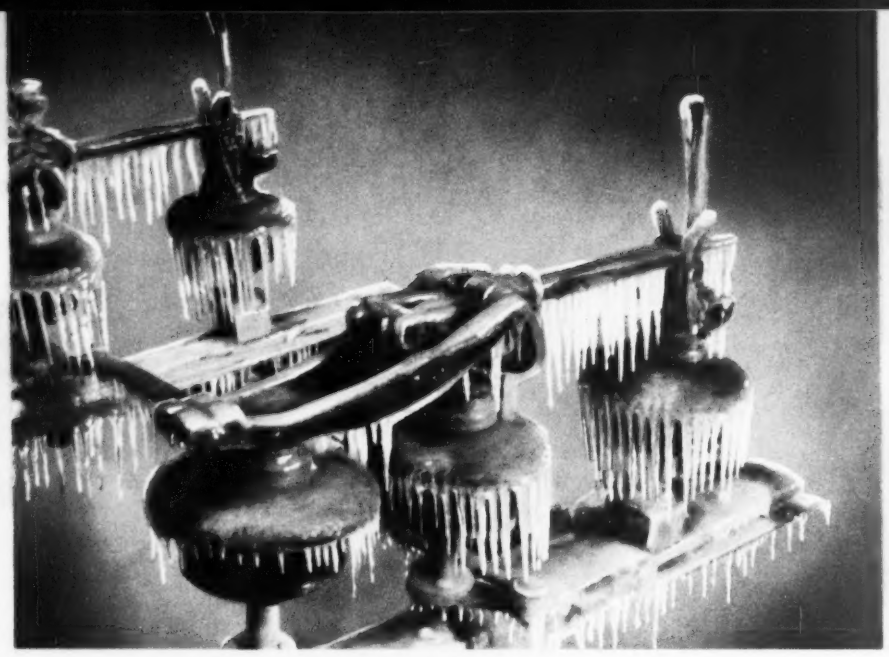
Harper fastenings protect equipment from costly breakdowns—provide added insurance against serious outages. Harper specializes in fastenings of corrosion-resistant metals—silicon bronze, copper, aluminum, naval bronze, brass, Monel, nickel and stainless steel. More than 7,000 different items are carried in stock. Skilled metallurgists and engineers are ready to consult with you on any specialized design or alloy to meet your requirements. See the Harper Branch Office or Distributor in your area, or write for Catalog 25.

THE H. M. HARPER COMPANY
8205 Lehigh Avenue, Morton Grove, Illinois

BOLTS • NUTS • SCREWS
WASHERS • RIVETS • SPECIALS
SILICON BRONZE • COPPER • ALUMINUM
NAVAL BRONZE • BRASS • MONEL
NICKEL • ALL STAINLESS STEELS

¾—10 x 3½"
Hexagon Head
Silicon Bronze
Machine Bolt





Icing as heavy as this seldom or never occurs. But the powerful L-M mechanism easily breaks the ice, assuring dependable, positive operation under all conditions.

L-M Introduces Revolutionary New Line of Power Switching Equipment

Present situation shows need for improved switching equipment. L-M's new line designed to solve problems arising from icing, corrosion, and operation.

By **R. D. CLEAVES**
Manager,
Protective and Switching
Equipment Sales,
Line Material Company

Considerable research has been conducted by various manufacturers to improve power switching equipment. Yet equipment now available still leaves much to be desired.

Because of its wide experience in the design and manufacture of electrical transmission and distribution equipment, Line Material felt that it could make a worthwhile contribution to the switching equipment industry. Our new equipment is as great an advance over equipment available as it is over our own previous line.

The switches now presented offer an entirely new concept in switch design. They include such features as these: silver-insert-to-silver-insert high-pressure contacts; ball bearings lubricated for life and sealed with silicone cord rings; rotating switch blades with a very powerful lever advantage and a substantially different motion that breaks any ice, snow, or corrosion we have been able to apply to the mechanism; a new contact design; a new interphase assembly that transmits a very high percentage of the applied power to the switch mechanism.

The line is simple, not complicated. Operation is positive, with the fewest number of parts. There are a minimum number of current interchange points. Terminals of an ingenious design provide for connections to a wide variety of conductor sizes.

Switches are for both pole and structure mounting. Mountings may be horizontal, vertical, or inverted. Interphase assembly may be direct or indirect connected, with or without outboard bearings.

Silicone cord ring sealed bearings at all moving joints from the operating handle through the interphase mechanism including the switch provide for easy operation.

Get Full Information

Ask the L-M Field Engineer for complete information and bulletin on the new line; or write Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

Features of L-M's New Power Switching Equipment

Contact assembly provides 175 pounds pressure; simple method for field adjustment.

Silver inserts in both blade and contact shoes assure high current-carrying capacity at both jaw and hinge contacts. Blade rotates 26 degrees before it starts to rise, assuring positive breaking of ice or corrosion.

All bearings including main bearings are silicone grease lubricated and sealed for life with silicone cord rings. No further lubrication required. Water can't get in and freeze bearings. Bearing stops are internal, so ice can't interfere with switch operation.

Fewer current interchange points than any other switch assures cool operation.

Ingenious terminal blocks provide positive grip for many sizes of conductors.

Ample hinge clearance so that ice can't block lever arm or hinge mechanism.

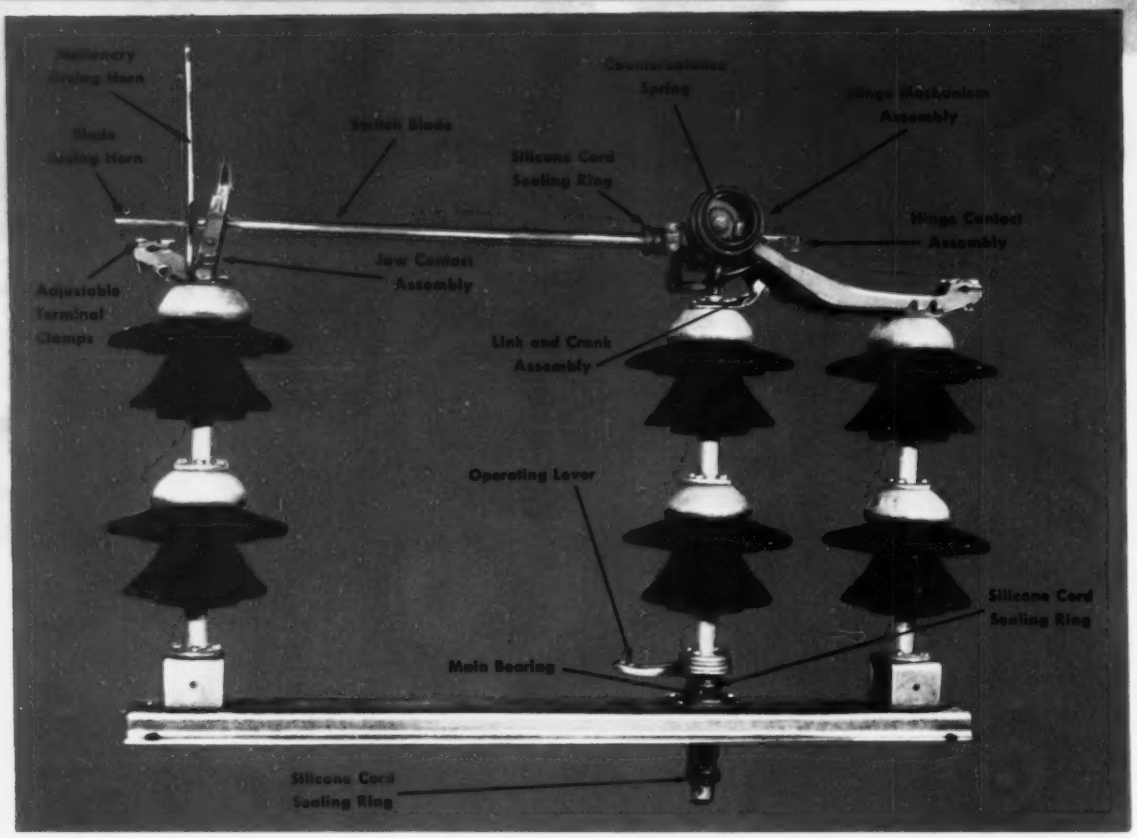
Design places ice on any moving part of the switch in cantilever instead of shear; powerful lever advantage breaks ice or corrosion.

The 69 kv units have counterbalance weight for inverted mounting, and self-centering double back-wound counterbalance spring for horizontal and vertical mounting.

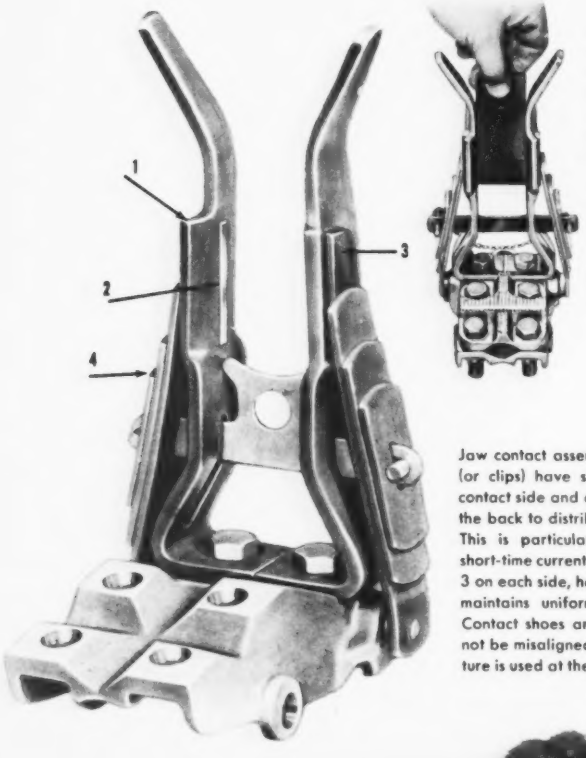
Interphase assembly eliminates misalignment problems. Provides wide flexibility for any type of installation. Silicone cord ring sealed, lubricated joints assure easy operation and full transmission of power.

LINE MATERIAL

Power Switching Equipment

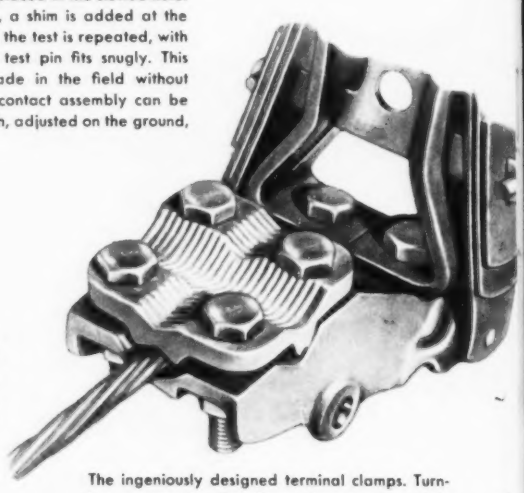


L-M's new 69 kv 600 ampere rotating insulator switch, showing some of the features that make this equipment outstanding. Solid parts are high-grade aluminum bronze alloy (not the bronze alloy commonly used). This is strong, permits use of lighter cross-sections, and is virtually free from corrosion. There are only 6 current interchange points in the entire switch!

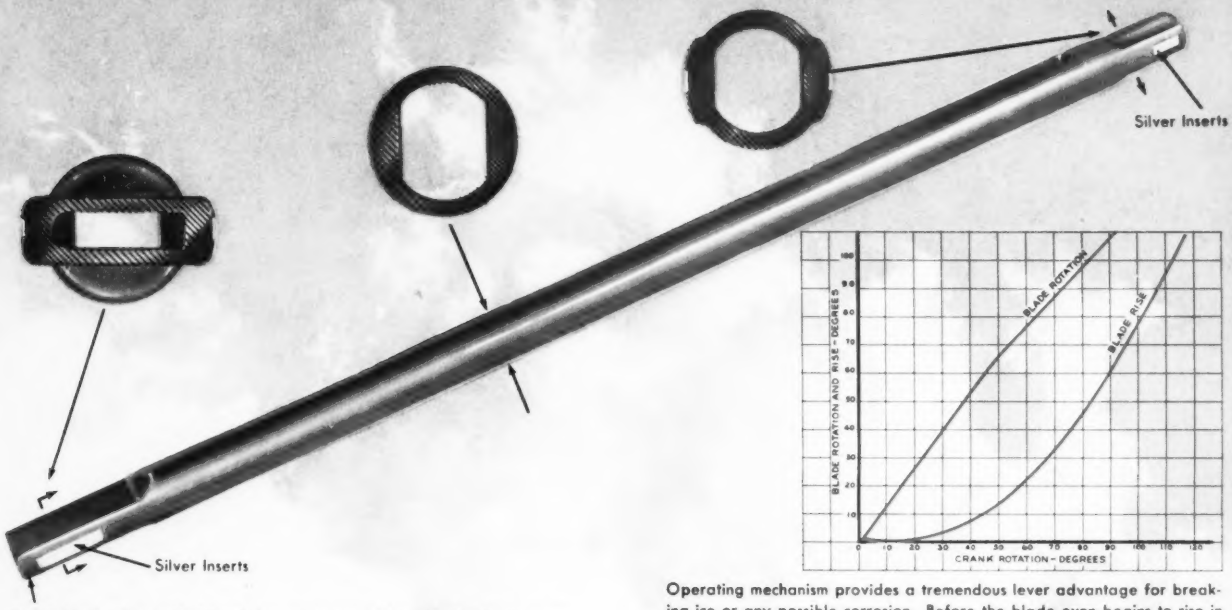


Jaw contact assembly. (1) Contact shoes (or clips) have silver inserts (2) on the contact side and a block of copper (3) on the back to distribute and dissipate heat. This is particularly important for high short-time current capacity. (4) Springs—3 on each side, held by the tie bar, which maintains uniform 175-pound pressure. Contact shoes are easily replaced, cannot be misaligned. A similar contact structure is used at the hinge end of the blade.

A simple gauge has been devised for adjustment. This consists of a test tie bar which replaces the regular tie bar while a contact gauge block is placed between the contacts to assure proper spacing. The test pin is placed in the slotted hole. If the test pin wobbles, a shim is added at the base of the spring, and the test is repeated, with shims added until the test pin fits snugly. This adjustment can be made in the field without costly equipment. The contact assembly can be removed from the switch, adjusted on the ground, and then replaced.

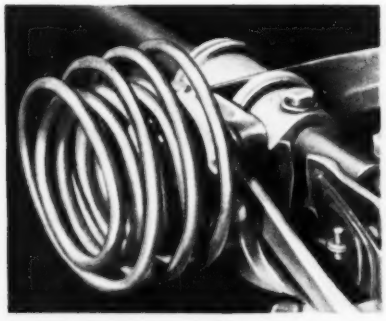


The ingeniously designed terminal clamps. Turning or reversing the clamp plate provides tight clamping of conductors or tubing from #6 solid to 1 5/16" diameter. Conductor can enter terminal clamp from three sides in horizontal plane. Terminal base will accept lug or bus bar connnection.

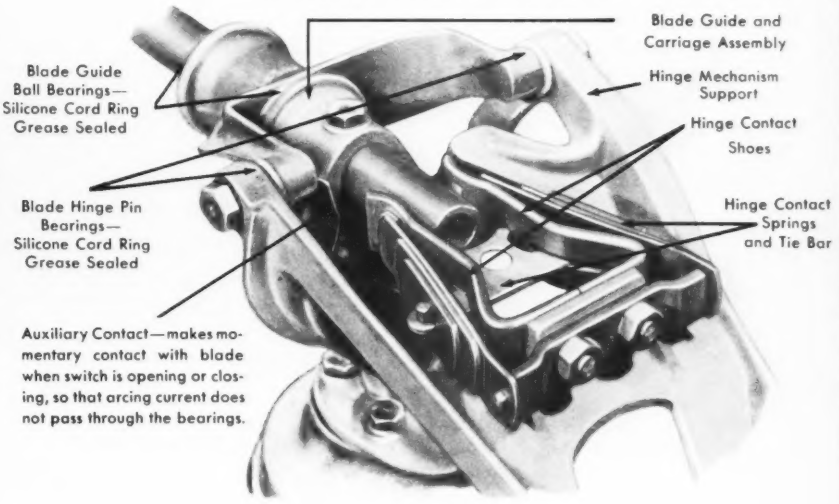


Switch blade of extruded hard-drawn copper tubing. Notice, in the cross section, the heavy internal backup material that provides extra strength and thermal capacity, permitting the use of a smaller diameter blade which breaks ice more easily. To change blades only one bolt is removed.

Operating mechanism provides a tremendous lever advantage for breaking ice or any possible corrosion. Before the blade even begins to rise in the contacts, it is rotated 26 degrees—the full force being applied to blade rotation. This breaks ice and corrosion and also moves the silver inserts in the blade away from the silver inserts in the contact shoes, so the silver gets very little rubbing. During the first 30 degrees of rotating insulator motion, the blade rises only 3 degrees but is rotated a full 40 degrees. On closing, as the blade comes down, there is no silver-to-silver contact until the blade is completely in the contacts. Blade rotation at this point against the preloaded springs establishes full contact pressure.



On 69 kv ratings we provide a blade counterweight or an ingeniously designed counterbalance spring to counteract blade weight. This is a self-centering back-wound double-coil floating spring. The spring is not wound on a mandrel; thus the beginning motion of an opening or closing operation cracks any ice on the spring. No ice shielding is required.


Blade Guide and Carriage Assembly
Hinge Mechanism Support
Hinge Contact Shoes
Hinge Contact Springs and Tie Bar
Blade Guide Ball Bearings—Silicone Cord Ring Grease Sealed
Blade Hinge Pin Bearings—Silicone Cord Ring Grease Sealed
Auxiliary Contact—makes momentary contact with blade when switch is opening or closing, so that arcing current does not pass through the bearings.

Hinge Mechanism Assembly—"the Heart of the Switch"

Smooth and positive blade rotation and blade rise are provided by a carefully engineered crank and lever mechanism.

The design is such that there are no "humps" in its action; it moves smoothly and positively through the whole operation. Ample clearance positively eliminates operation difficulties under the most severe icing conditions.

Sealed bearings throughout make the switch a positive performer. All bearings are lubricated for life with silicone grease and sealed with silicone cord rings. Grease can't get out; water can't get in to freeze or start corrosion.

LINE MATERIAL

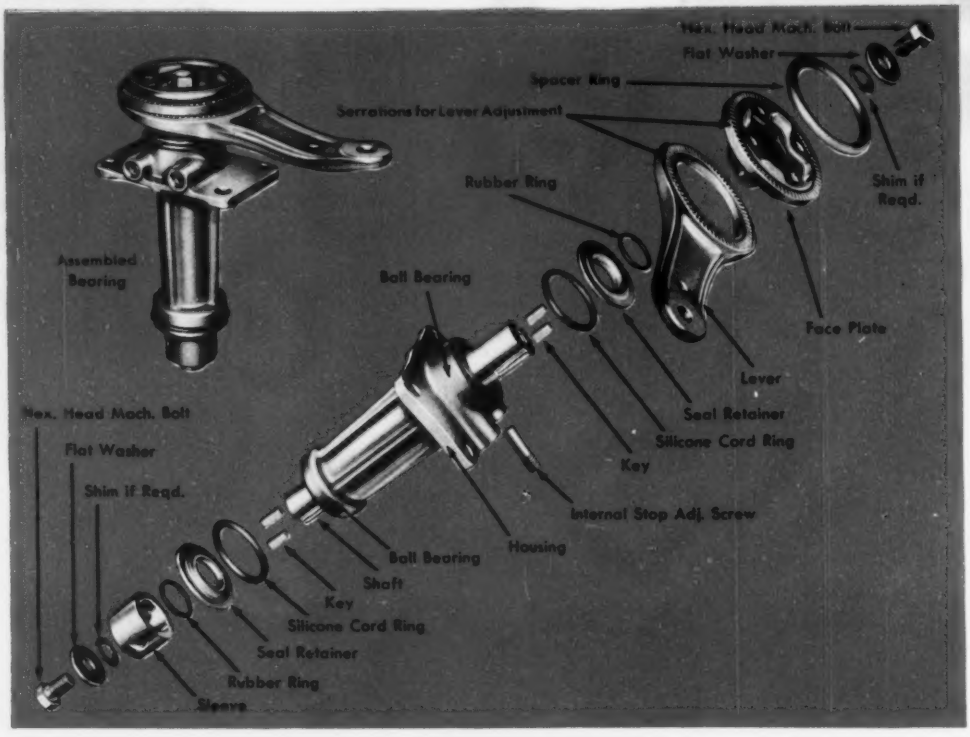
Power Switching Equipment

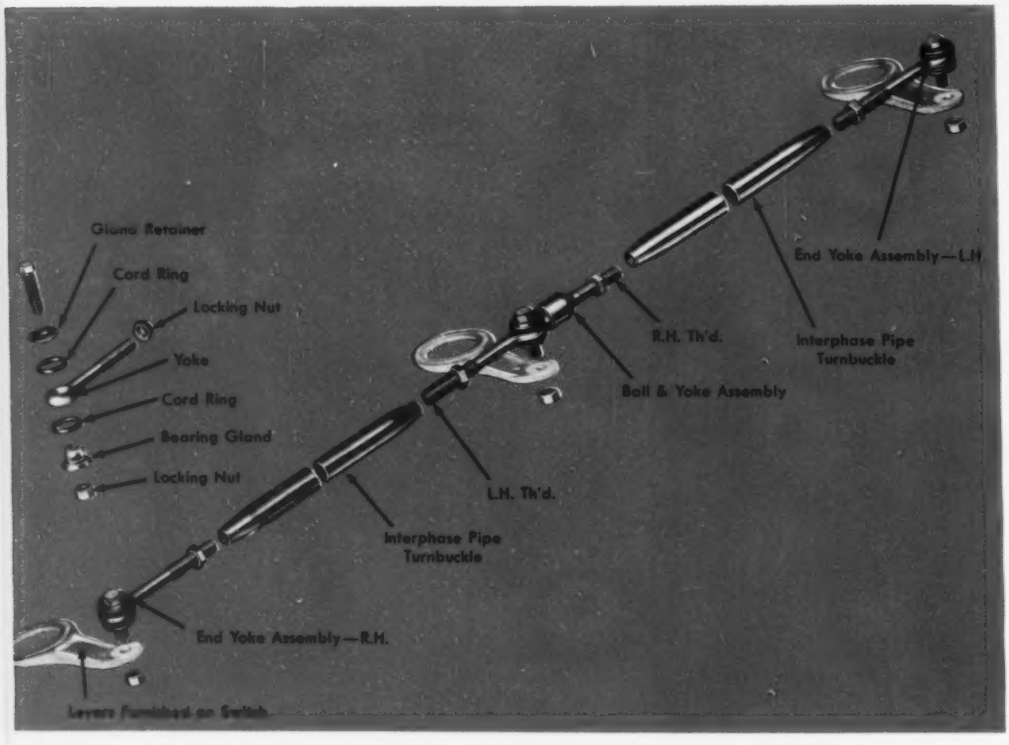
LM

The Main Bearing

Supports the rotating insulator and allows it to rotate on its own axis in operating the switch. Ball bearings are lubricated for life with silicone grease, which is sealed in with a silicone cord ring. (Use of these rings as bearing seals is not new, but they have never before been used in switch bearings.) Interphase stops are internal where ice cannot reach them. They are accurately adjusted at the factory but may be adjusted in the field if necessary.

Cap and pin or post type insulators are bolted to top of the face plate. Interphase mechanism is connected to the operating lever arm. The operating lever arm can be positioned to provide, within 2½ degrees, adjustments over a range of 360 degrees.





Interphase Assembly

In opening and closing under abnormal conditions, difficulties with present equipment are caused by the mechanism itself using up much of the applied operating power. In the L-M mechanism all joints are lubricated and sealed with a silicone cord ring. These rings are flexible; ice doesn't adhere to them. Ice can't get into the joints. Thus joints are always clear and operate easily. Substantial ice clearance distance is provided between all operating levers and switch bases. The mechanism requires very little power to operate under any condition, and most of the power from the operating handle is transmitted to the switch mechanism with minimum lost motion.

The interphase assembly is extremely flexible and very easily assembled to switch operating levers. It can be assembled on the ground prior to attachment to switch. Misalignment of switch bases, unless very extreme, will automatically be compensated for by the yoke and ball-and-socket assembly. Varying interphase spacings are no problem with the turnbuckle adjustment provided.

For complete information about L-M Power Switching Equipment, talk to the L-M Field Engineer; or write for bulletins to Line Material Company, Milwaukee 1, Wisconsin (a McGraw Electric Company Division).

LINE MATERIAL

Power Switching Equipment

LM

☑ CHECK General Cable SUPERSHEATH "TRIPLETS"

FOR ALL POWER and CONTROL APPLICATIONS

Whatever your electrical wiring needs—power, lighting or control—they can be easily and efficiently handled by General Cable SUPERSHEATH "Triplets."

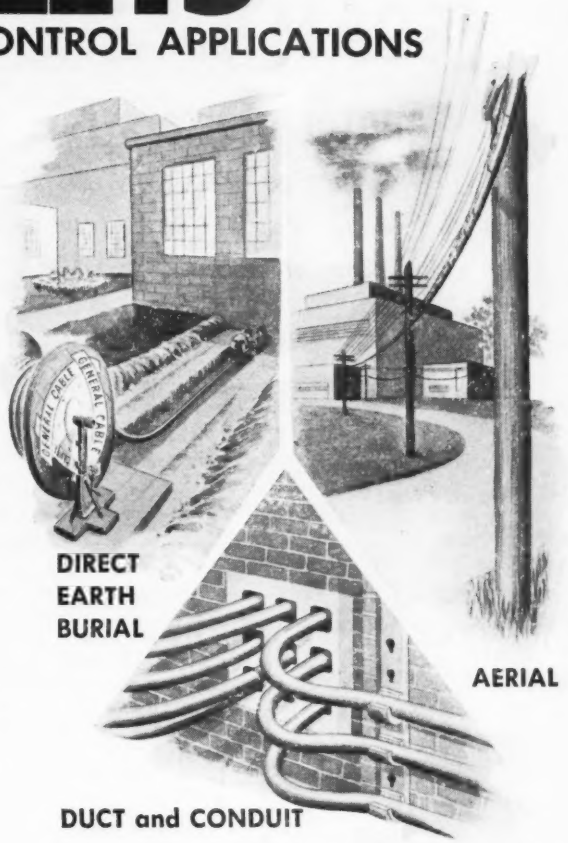
SUPERSHEATH "Triplets"

Type USE—THERMAX W insulation with **NEOPRENE** jacket for direct earth burial service entrance.

Type RHWN—THERMAX W insulation with **NEOPRENE** jacket for aerial, duct, conduit and direct earth burial applications.

Type GN—GENCORONE (corona resistant) insulation with **NEOPRENE** jacket for medium and high voltage applications—all types.

For quick, dependable information on how the SUPERSHEATH "Triplets" can solve your wiring problems, for new installations, expansion and modernization, call your nearest General Cable representative today.



Other Principal Products Made for Utilities Include:

Rubber and Plastic Power and Control Cables—Rubber or GENCORONE (corona resistant) or plastic insulated with braided, leaded, and armored finish.

Bare Wires—Regular and TENSILOK copper, all aluminum and A.C.S.R. conductors.

Weatherproof Wires—OK, PEERLESS textile covered, TIP-TOP neoprene covered, polyethylene covered; with regular or TENSILOK copper, copperweld, all aluminum, or A.C.S.R. conductors.

Service Drop Cables—Copper or aluminum conductor—ENTERITE, Type SD, PEERLESS and aerial messenger types.

Service Entrance—SUPERSHEATH type USE, SE style U, SE style A.

Series and Multiple Street Lighting Cables—buried, duct, or aerial (mast arm or arc drop) rubber, GENCORONE or polyethylene or plastic insulated with leaded or neoprene jacket finish.

Paper Power Cables—solid, low pressure gas, and oil filled with leaded, neoprene over lead and armored finish. Pipe types (high and low pressure) oil and gas filled.

Asbestos-Varnished Cambric, and all asbestos station and control cables.

Varnished Cambric—power, control, apparatus and station cable, with braided, leaded, or interlocked steel tape, bronze, and aluminum armored finish.

GUARDIAN Rubber and Plastic Building Wires

Tree Wire **...and other types**

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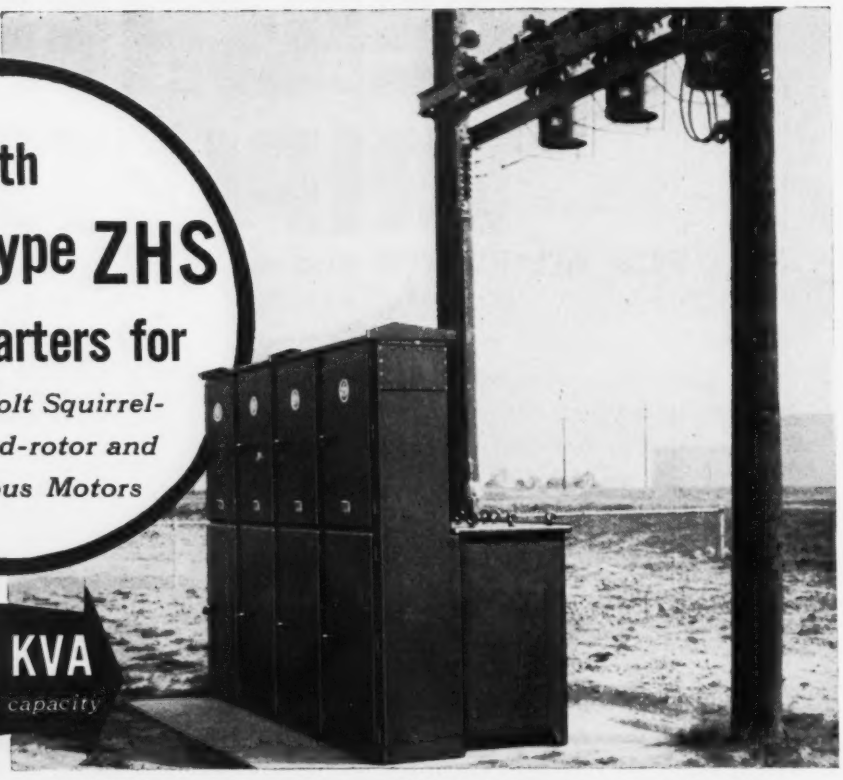
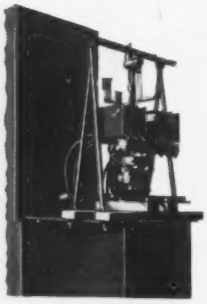
motor starters for

2300 - 5000 Volt Squirrel-cage, Wound-rotor and Synchronous Motors

50,000 KVA
interrupting capacity



Four EC&M High Voltage Starters, outdoor mounted in Sun Oil Company's Sun Station Terminal at Nederland, Texas, provide push button remote starting and full protection for the motor-pump drives.



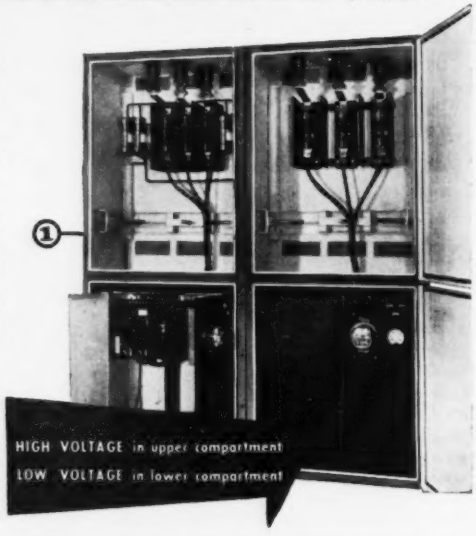
Contactor-lifting mechanism raises ZHS Contactor for easy inspection or contact renewal. No bolts or wires need be removed for this operation.

For important "main-line" drives, EC&M Type ZHS Starters give complete protection these four ways: 1) SHORT CIRCUIT Protection, 2) MOTOR Protection, 3) LOW VOLTAGE Protection, 4) PERSONNEL Protection.

Enclosures available for all requirements. Indoor or outdoor mounting—Type VIII Construction for Class I, Group D Hazardous Locations and Type IA for dusty atmospheres.

When making initial cost estimates, get the facts on EC&M High Voltage Starters. Our nearby office will be glad to supply full information on starters which give complete protection.

Write for Bulletins 1062 & T9-117



① Provision for future mounting of VALIMITOR (volt-ampere-limiter) coils for unlimited protection—bus KVA capability may be infinite.

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Automatic Home Laundries

The Hotpoint Electric Water Heater, Automatic Washer, Electric Dryer, and Rotary Ironer are **all** *revenue-building components of the Hotpoint Automatic Home Laundry.*

The automatic electric home laundry provides the electric utility company with an important source of revenue. It probably represents a greater source of domestic revenue than any other group of appliances in the home—and in a majority of cases the home laundry operates at off-peak hours. Due to their current low saturation, the components of the electric home laundry offer the electric utility company the greatest opportunity for balancing and building future domestic load.

Hotpoint pioneered and has manufactured more than one-third of the electric water heaters in use today. The Hotpoint Dryer with its sealed-chamber drying action is years ahead of the rest of the industry.

The Hotpoint Automatic Washer with its two-cycle WOND-R-DIAL control for normal wash or delicate fabrics is setting all-time sales records, and the Hotpoint Rotary Ironer incorporates *all* the prominent sales-making features.

This is the home laundry line that is making it easier for you to get more laundry appliances on *your* line. Have your Hotpoint distributor give you the full story.

Again Hotpoint looks at Tomorrow, Today

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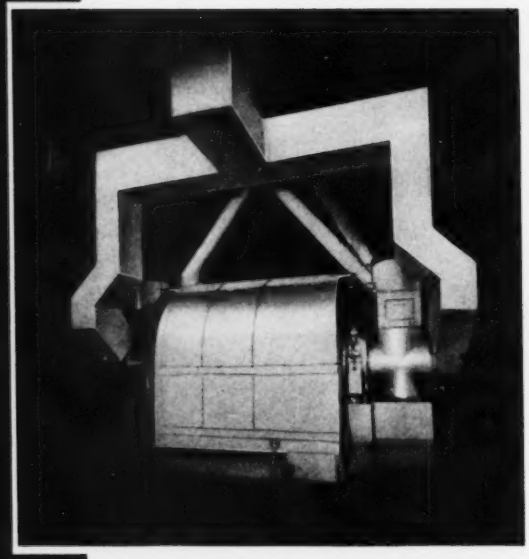
STEAM GENERATORS for every central station or industrial use, designed, engineered and built to meet your needs for the economies of higher temperatures and pressures over control ranges not previously obtainable.



BALL MILL PULVERIZERS which grind hard, abrasive fuels to a constant fineness. Operating records show low maintenance, high availability of 99% or better.

SUPERHEATERS of the convection and radiant type, either singly or in combination. Superheat control over a wide load range is also offered as a means of positive and accurate control of final temperature.

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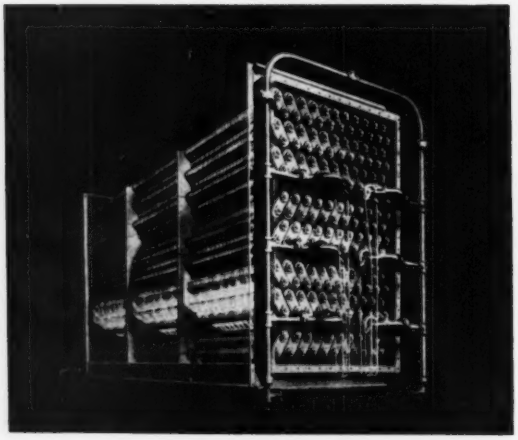

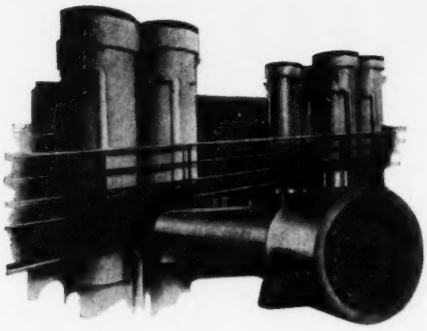

PACKAGE STEAM GENERATORS in capacities of 10,000 to 30,000 lb. of steam per hr. Water-tube type, plant assembled, shipped ready to install. Design pressures of 250, 525, 825 psig provide operating pressures from 100 to 800 psig.

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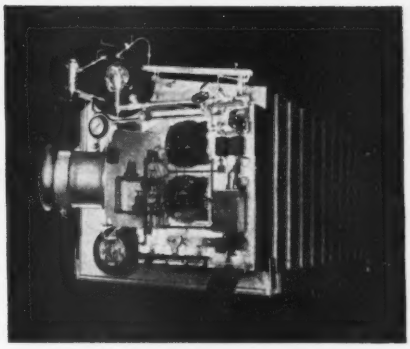

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IN OVER 50 YEARS of service to the power industry, Foster Wheeler has pioneered the development of steam generators, fuel systems, condensers and cooling systems of the highest efficiency. Continuous research and engineering have created a background of technical experience, *as well as* an integrated line of equipment in which each individual product is designed to contribute to the efficiency of all.

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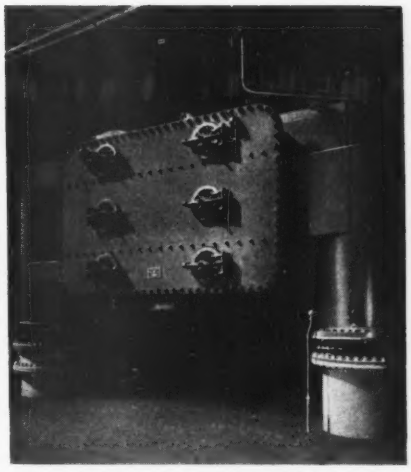

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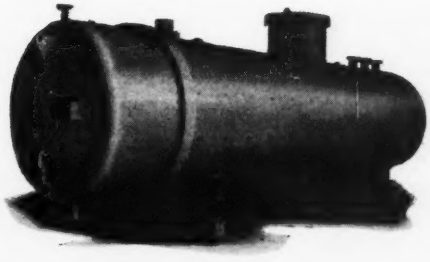
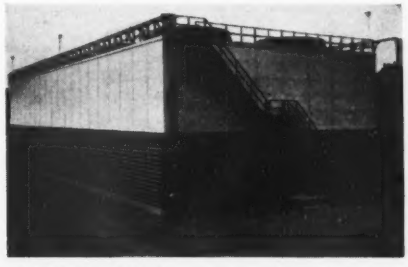
EVAPORATORS for boiler feed make-up and of heat-transformer types in all sizes. Special types to handle raw and treated make-up to give the best thermal and descaling operation as well as producing pure vapor.





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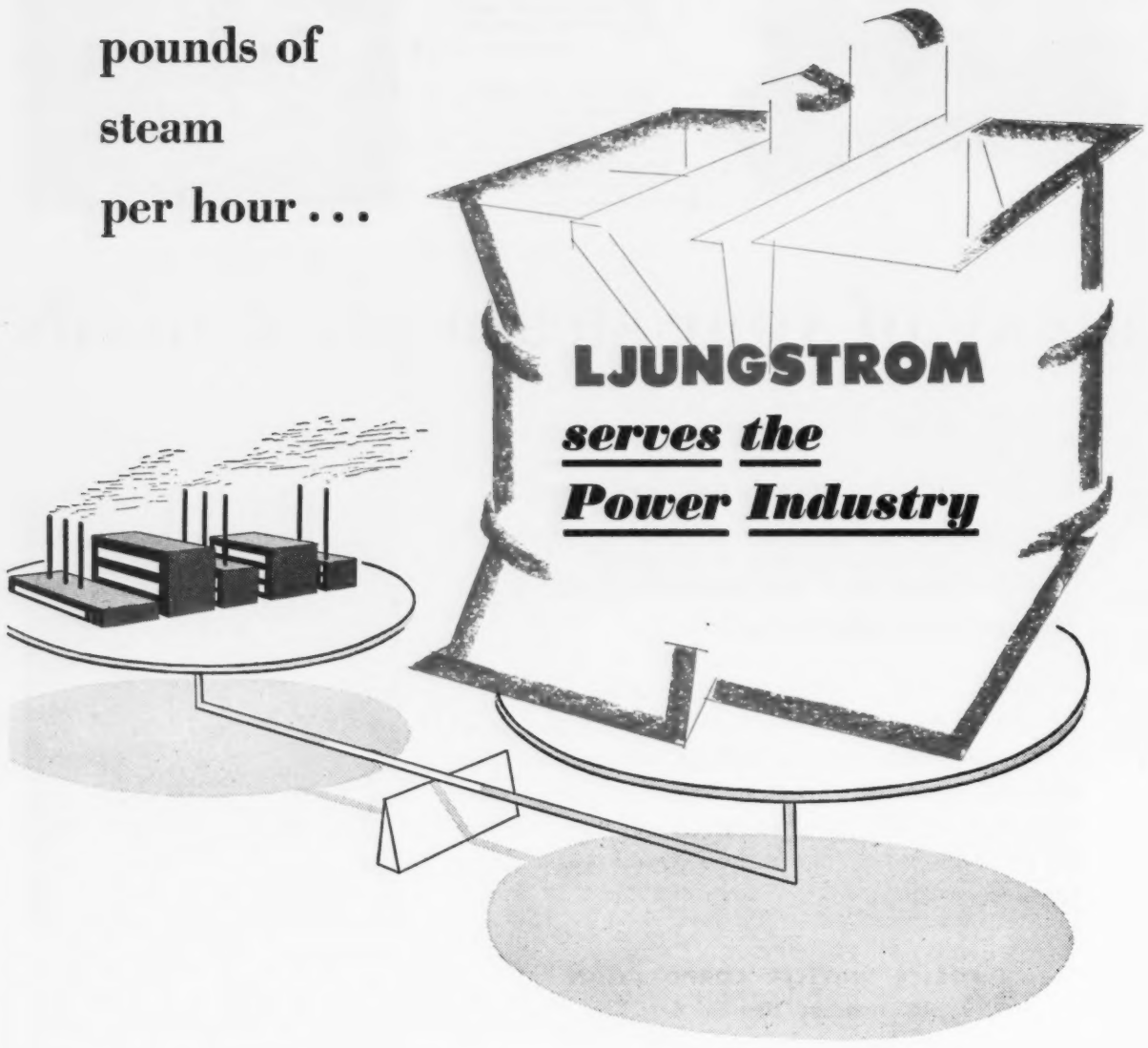

In the post-war rush to expand power generating facilities, utilities have not lost sight of the need for *operating economy*. Increasingly over these years, the fuel-saving, performance-improving potentials of the Ljungstrom Air Preheater have been realized – until today, nearly two out of every three power boilers are ordered with the specification "Ljungstom Air Preheater."

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This record speaks for itself. It proves that the Ljungstrom Air Preheater is, indeed, ***the most economical heating surface in the modern boiler.***

The AIR PREHEATER CORPORATION

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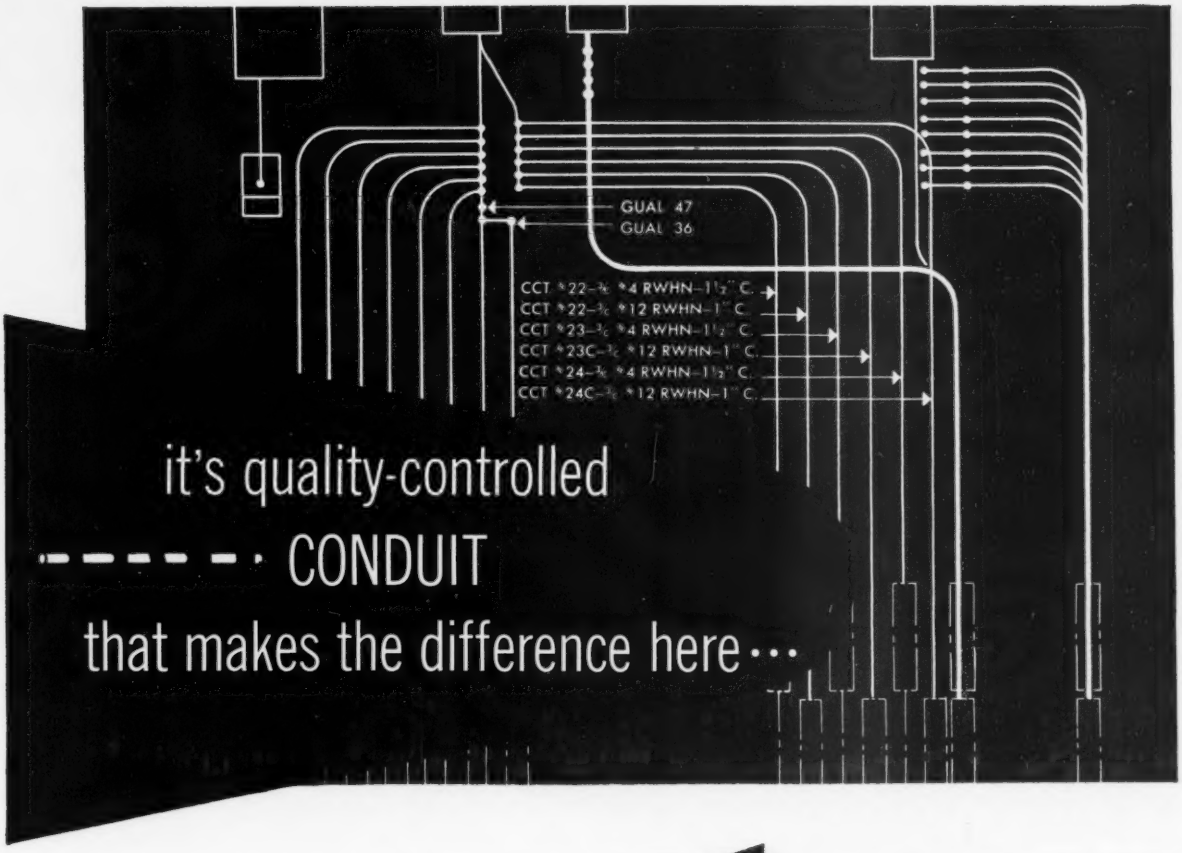

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The high-quality steel used in the manufacture of Spang Central Conduit is formed under exact heat conditions.

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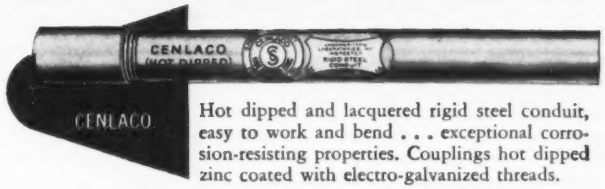
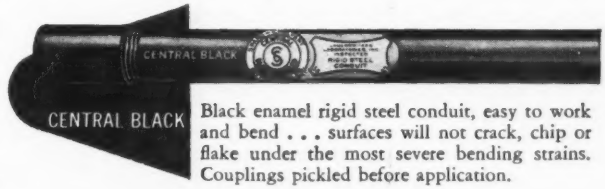
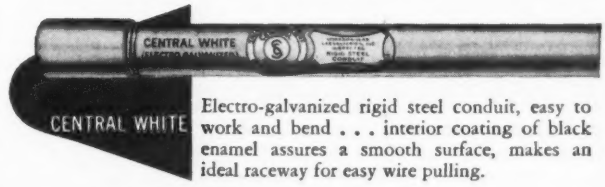
Spang produces conduit for every type of installation. Take your choice of any of the "big four" in a full range of sizes. And ask any electrical contractor about Quality-Controlled Spang Central Conduit—he'll tell you why Spang is best!



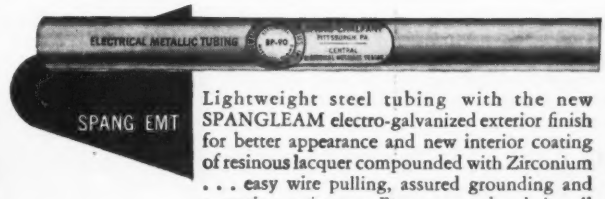
CENLACO — Hot dipped and lacquered rigid steel conduit, easy to work and bend . . . exceptional corrosion-resisting properties. Couplings hot dipped zinc coated with electro-galvanized threads.



CENTRAL BLACK — Black enamel rigid steel conduit, easy to work and bend . . . surfaces will not crack, chip or flake under the most severe bending strains. Couplings pickled before application.



CENTRAL WHITE — Electro-galvanized rigid steel conduit, easy to work and bend . . . interior coating of black enamel assures a smooth surface, makes an ideal raceway for easy wire pulling.



SPANG EMT — Lightweight steel tubing with the new SPANGLEAM electro-galvanized exterior finish for better appearance and new interior coating of resinous lacquer compounded with Zirconium . . . easy wire pulling, assured grounding and corrosion resistance. Easy to cut, bend, install and weld.

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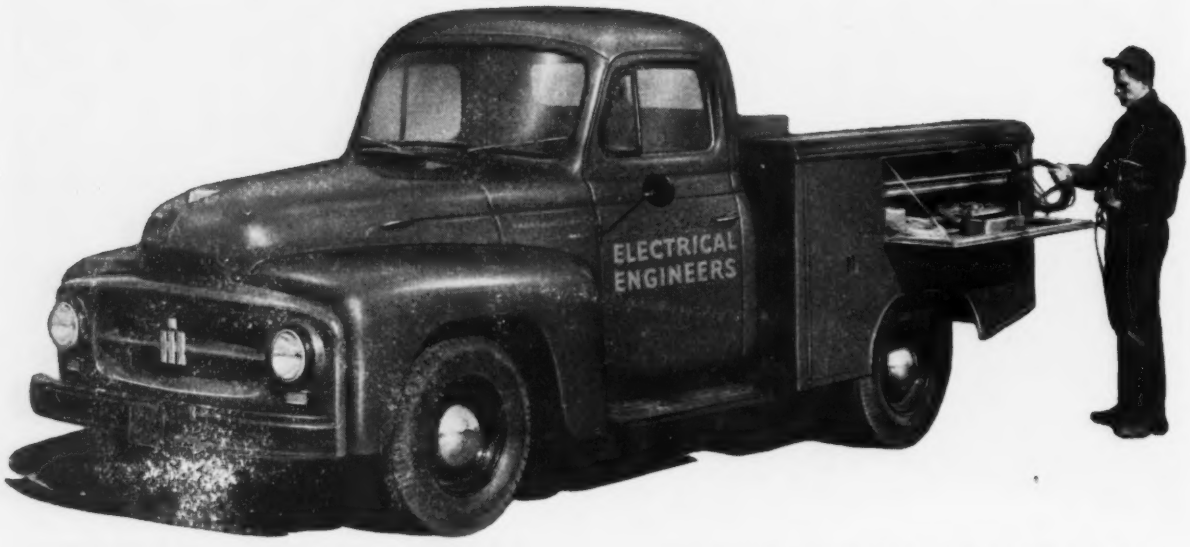

New INTERNATIONAL Model R-110 with Service-Utility body. GVW rating, 4,200 lbs. 127-inch wheelbase. Six models with Service-Utility bodies available — 77-inch body lengths for 115-inch wheelbase; 89-inch lengths for 127-inch wheelbase models.

The purchase of an INTERNATIONAL Truck with Service-Utility body is an investment that pays real dividends . . . in time saved on the job, time saved in job-to-shop trips for forgotten parts or equipment.

For INTERNATIONALS with Service-Utility bodies let repairmen take everything they need right with them . . . on every service call.

The Service-Utility body design has big capacity, locking side compartments to provide space for all tools and parts, with built-in trays to keep them orderly and ready for quick use. And many other types of specialized equipment, such as pipe racks, ladder racks, vise brackets and center section covers are also available.

The new Silver Diamond engine that powers these INTERNATIONALS assures top performance. The famed stamina of INTERNATIONAL means dependable, low-cost operation, long life.

Ask your INTERNATIONAL Dealer or Branch for complete details on these time-saving, money-saving trucks. Time payments arranged.

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International Harvester Builds **McCORMICK**® Farm Equipment and **FARMALL**® Tractors . . . Motor Trucks . . . Industrial Power . . . Refrigerators and Freezers

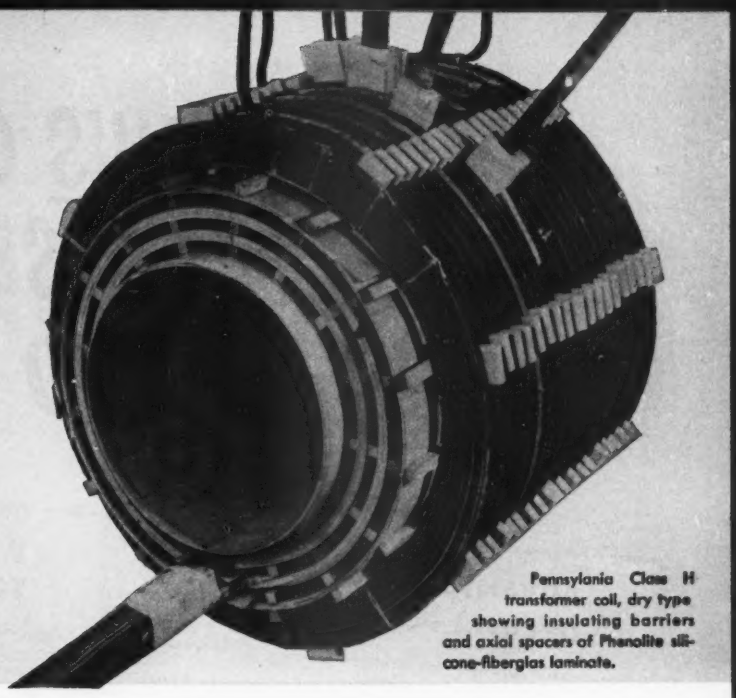
Better roads mean a better America

INTERNATIONAL® TRUCKS

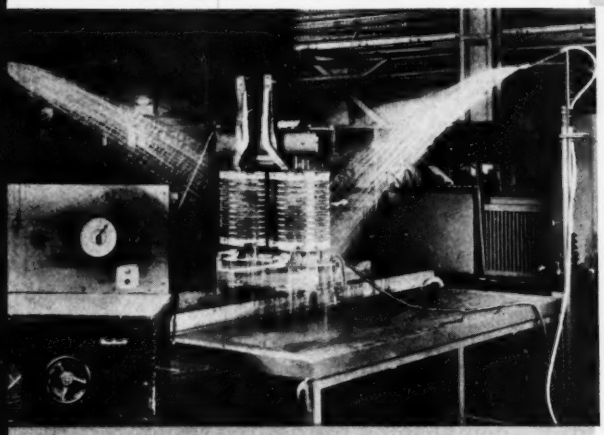
"Standard of the Highway"

class h insulation by National Vulcanized Fibre Co.

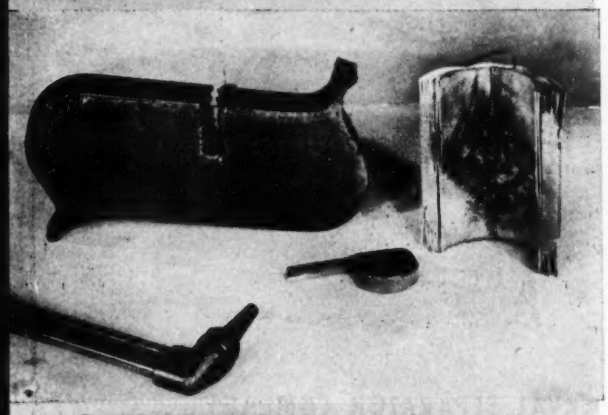
used by Pennsylvania Transformer Co. to build new, safe, and reliable Sealed Dry Type Transformers



Pennsylania Class H transformer coil, dry type showing insulating barriers and axial spacers of Phenolite silicone-fiberglas laminate.



Transformer core and coil assembly under full voltage excitation withstands heavy water shower. The insulation resistance remained at infinity megohms during the entire two-hour water test.



Class H insulation resists fire and combustion. The heat of the 5000° F. Oxygen-Acetylene torch, applied for the same interval, burned through the 2-inch steel plate, yet merely melted some of the glass fabric in the barrier.

Using Class H insulation (Phenolite silicone-fiberglas laminate), the Pennsylvania Transformer Company (a McGraw Electric Co. Division) builds Sealed Dry Type Transformers having many superior and safe operation features. The Class H Insulation eliminates the hazards of fire and explosion, permits up to 50 per cent weight reduction, makes possible efficient operation in humid atmosphere, reduces maintenance, allows operation at high temperatures, and permits frequent overloads. The coil barriers are made from 1/32 inch silicone sheets bonded with silicone rubber. The sheets are rolled directly onto the lathe during the coil winding operation, saving the high cost of a mandrel. Ideal for station auxiliary, unit substation and network service, these Sealed Dry Type Transformers are an outstanding example of National cooperative engineering and research. Perhaps you have an insulating problem where National Vulcanized Fibre Company can give you real help in solving your particular problem . . . economically. Write us—our engineering service is immediately available.

National laminated plastics
nationally known—nationally accepted

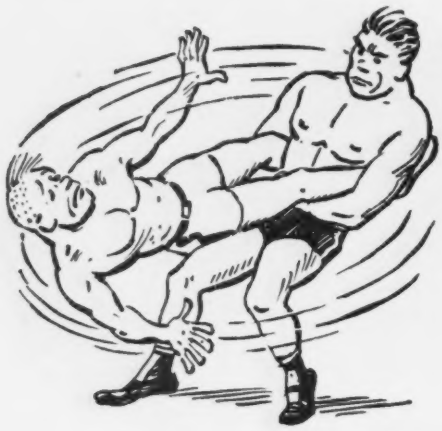
NATIONAL VULCANIZED FIBRE

PHENOLITE Laminated PLASTIC

NATIONAL VULCANIZED FIBRE COMPANY
Wilmington, Delaware

Since 1873

Offices in Principal Cities



THIS OIL PURIFIER TOSSES WATER OUT ...TO STAY OUT!

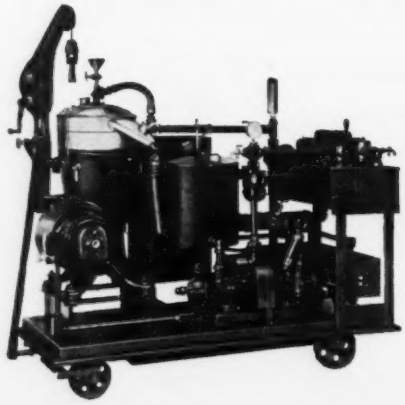
ADVANTAGE OF DE LAVAL PORTABLE OUTFIT	WHAT THIS MEANS TO THE POWER ENGINEER
✓ The De Laval centrifuge continuously discharges all water that is removed from the oil.	✓ No possible recontamination of the purified oil by removed water.

- Constant high purifying efficiency–no shutdowns for cleaning or for renewal of parts during run ✓
- Dehydrates at a single pass–no re-running
- Higher daily capacity of insulating oil saves maintenance costs ✓
- Heater cannot carbonize the insulating oil
- Safest–continuous discharge of water prevents re-contamination of the insulating oil ✓
- Centrifugal purifier is economical to operate
- Removes free water without aid of filter press; press used only to remove colloidal carbon ✓
- Low temperature purification; high dielectric value of oil maintained longer

A De Laval Insulating Oil Purifier provides the most simple . . . safe . . . and reliable method of maintaining the dielectric of transformer and circuit breaker oil. In the bowl of a De Laval centrifuge, water is ***continuously*** removed, and immediately discharged to waste.

The De Laval Oil Purifier always operates at constant efficiency. It cannot suddenly lose its effectiveness. There is no danger that a batch of oil in the process of purification will go in an instant from a high to a low dielectric test.

After 25 years, the De Laval method continues to be the most foolproof method of accomplishing the desired result.

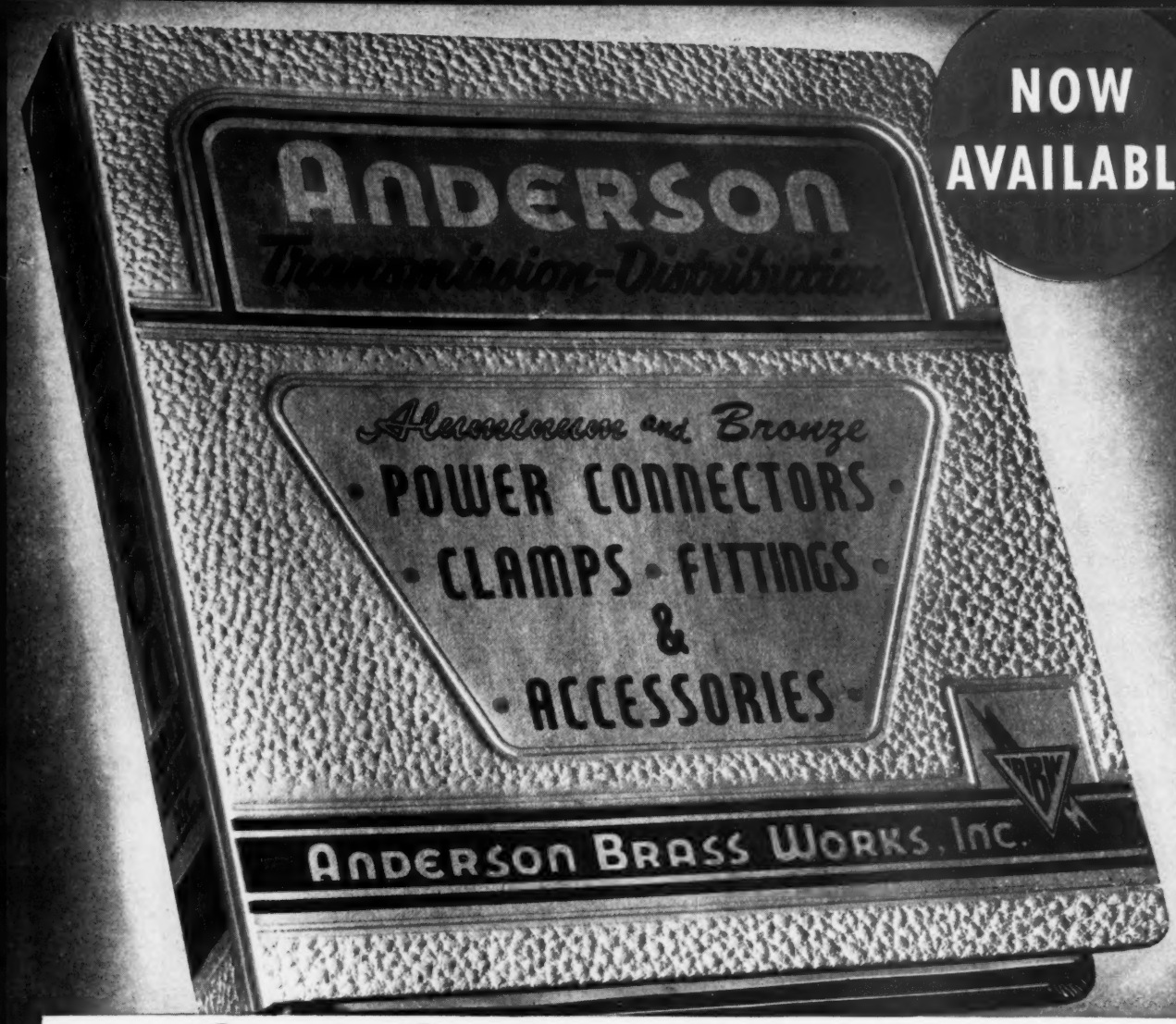


✓ CHECK THESE DE LAVAL SUPERIORITIES

THE DE LAVAL SEPARATOR COMPANY
Chicago POUGHKEEPSIE, N.Y. San Francisco

DE LAVAL

INSULATING OIL PURIFIERS



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EASIER TO WORK WITH...MORE COMPLETE...EASIER TO READ

One of the finest reference catalogs ever produced. Designed especially to serve as a handy, quick, information and buying guide for the specifier of Power Connectors, Clamps, Fittings and Accessories.

ATTRACTIVE, PERMANENT LOOSE LEAF BINDER . . . SEPARATE PRODUCT INFORMATION AND SPECIFICATION SHEETS. Also contains technical data section . . . a complete reference for the electrical power industry.

Write now for your free copy, or contact one of our nearest 20 representatives.

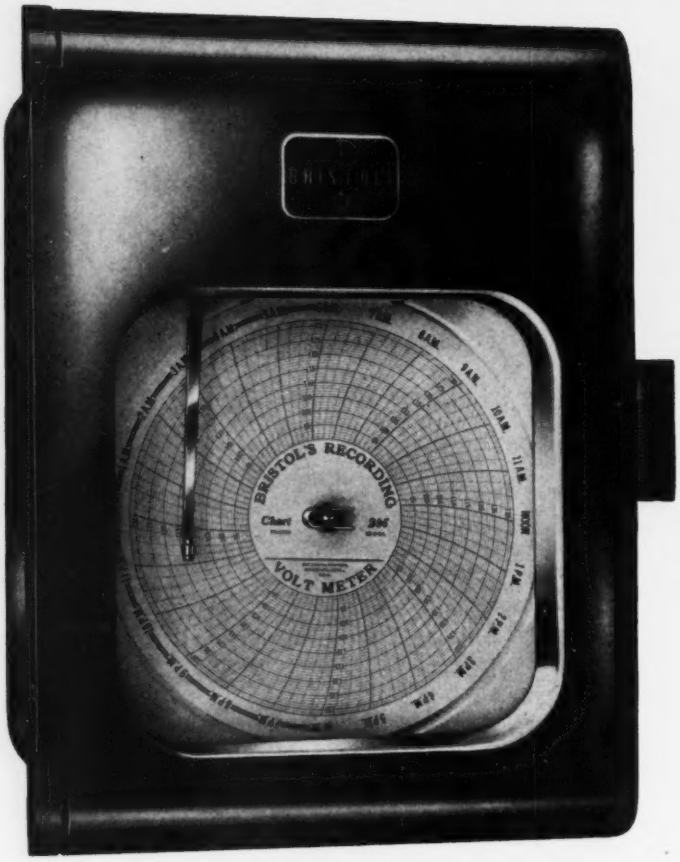
Aluminum & Bronze POWER CONNECTORS • CLAMPS • FITTINGS • ACCESSORIES
for SUBSTATION • TRANSMISSION • DISTRIBUTION

ANDERSON BRASS WORKS, INC.

P. O. DRAWER 2151 • BIRMINGHAM 1, ALABAMA

6 Reasons why you get greater accuracy with Bristol Series 500

RECORDING VOLTMETERS AND AMMETERS



1. Low burden—the lowest burden of any round-chart recorder on the market.

2. Extremely high torque gradient.

3. Temperature compensated.

4. Shock-proof moving element mounting.

5. Leveling of instrument not critical.

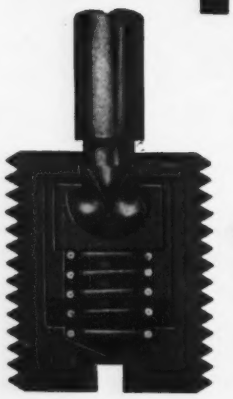
6. Continuously legible recording on sudden changes—up to full scale value.

Bristol Recording Voltmeters and Ammeters use moving-iron measuring mechanisms, known for high torque . . . refined by Bristol engineers for greater accuracy and ruggedness.

Advances in electrical measurement naturally come from Bristol, experienced for nearly 60 years in building hundreds of thousands of recording voltmeters and ammeters for almost every application . . . the finest, most dependable products.

Series 500 Voltmeters and Ammeters are designed for easy use, with dust- and moisture-proof die-cast aluminum case; quick-set chart hub for easy chart changing; non-obscuring pen lifter; and snap-on chart plate.

Find out all about these superior instruments by writing for Bulletin E1111 to THE BRISTOL COMPANY, (116) Bristol Road, Waterbury 20, Conn.



Permanent mounting offered in three models: interchangeable surface and flush, surface-panel and flush panel. Note the pleasing, well-balanced appearance. Also, *portable instruments* are offered in two models: for setting on floor or table; for mounting on walls or poles and general service.

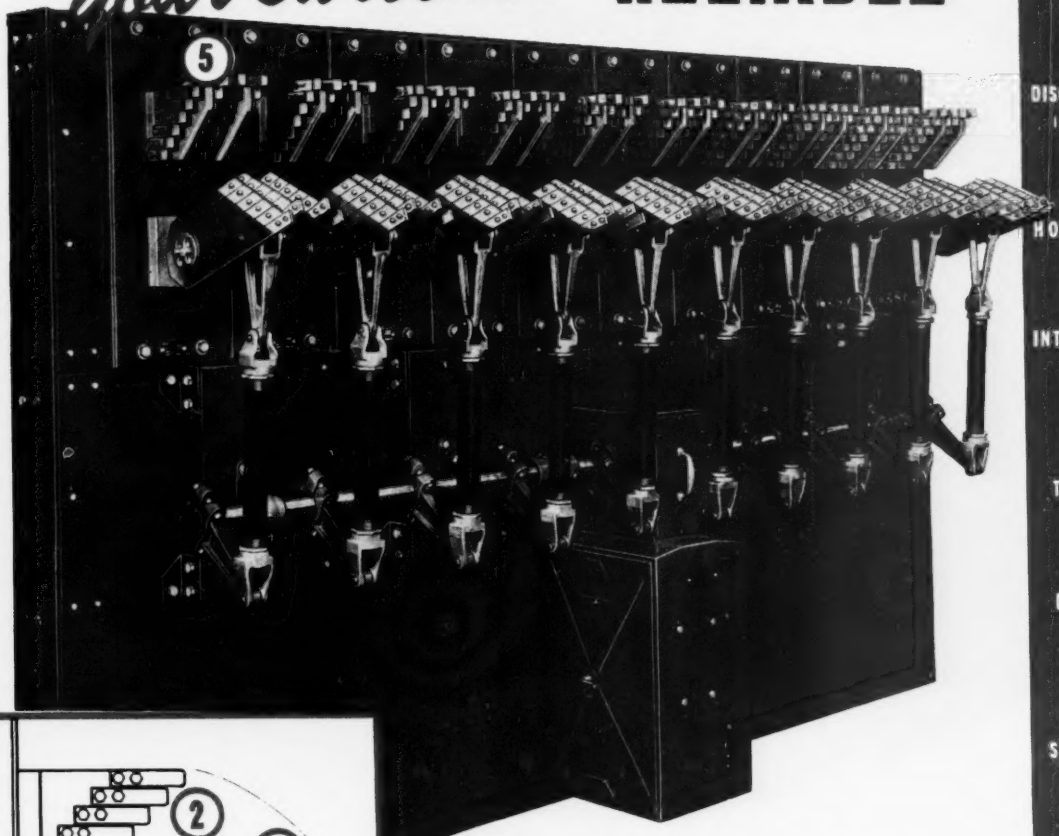
New ball-bearing suspension, loaded by a coil spring, prevents damage even under severe mechanical shock. Stainless steel bearings and shaft are almost tool hard and are corrosion-resistant.

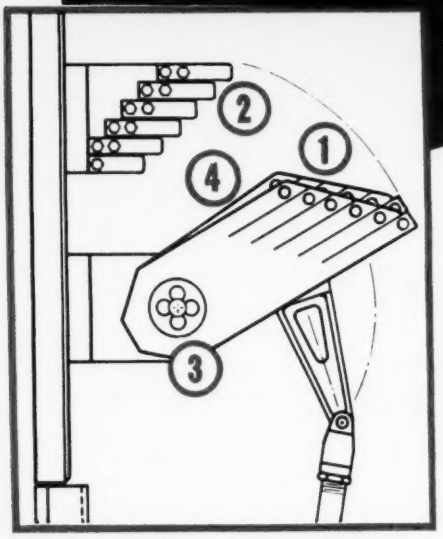
BRISTOL

The dependable Guidepost of Industry

AUTOMATIC CONTROLLING, RECORDING AND TELEMETERING INSTRUMENTS

Because you demand your switches RELIABLE





Drawing above shows a single pole 6,000 Amp. Switch for group operation.

Illustration above shows a special application of ten single pole switches with a total rating of 60,000 Amp. The switch is used to interrupt current and is installed in parallel with a 6,000 Amp. Breaker which remains closed until switch is fully open. When fully open, an auxiliary switch in the operating mechanism trips the breaker. Any slight arcing during transfer of current occurs at the special arcing fingers (5)

This type of installation is ideal for potline switching and reduces the cost of high capacity interrupting equipment.

Check the facts on the

60,000 Amp. Motor Operated HIGH PRESSURE CONTACT SWITCH

1. **HI-PRESSURE SPOT SILVER-TO-COPPER CONTACTS** - self-cleaning with each blade operation.
2. **CONTACT JAW** - Copper tongue and beryllium copper contact fingers - providing high conductivity, together with proper application of strength and resiliency.
3. **HI-PRESSURE HINGE CONTACTS** - uniform pressure in all blade positions through annular, live contact blade surface. Uniform pressure maintained by use of special spring washer with less critical adjustment than ordinary cup spring washer.
4. **EASY BLADE OPERATION** - through sequence blade movement - contact pressure released from inside pair of blades before the outside pair start movement.

I-T-E R&IE

R & I E EQUIPMENT DIVISION

I-T-E CIRCUIT BREAKER CO.

GREENSBURG, PA.

The Check List

CONDUCTOR SUPPORTS, CLAMPS AND FITTINGS

DISCONNECTING SWITCHES INDOOR AND OUTDOOR

HORN GAP SWITCHES

INTERRUPTER SWITCHES

CUTOUTS AND THERMO-RUPTERS

DISTRIBUTION EQUIPMENT

SWITCH OPERATING MECHANISMS

SUBSTATIONS

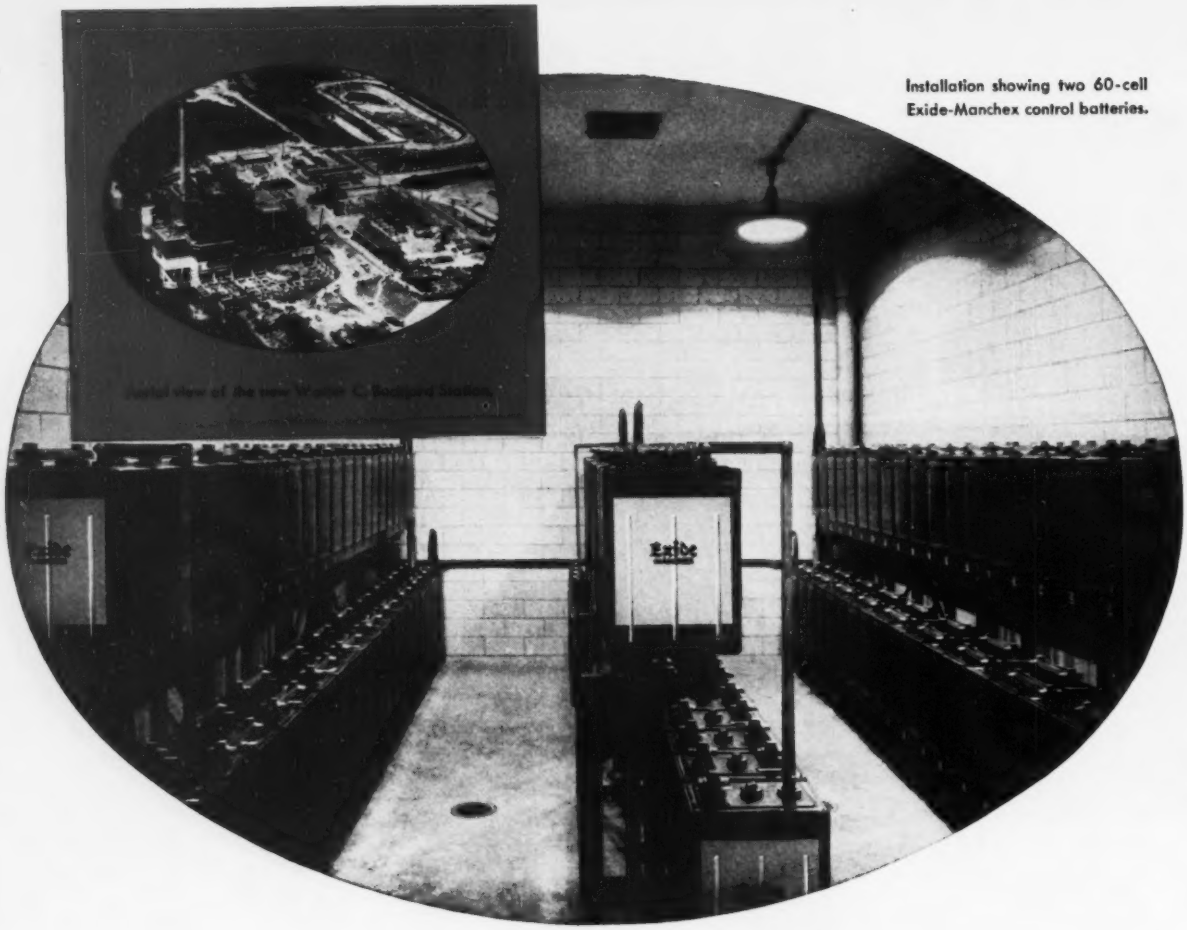
OPEN OR ENCLOSED, ISOLATED PHASE HEAVY DUTY BUSES

KIRK INTERLOCK SYSTEMS

AUTOMATIC SWITCHING EQUIPMENT

METAL CUBICLES

TESTING DEVICES



Installation showing two 60-cell Exide-Manchex control batteries.

CINCINNATI GAS & ELECTRIC COMPANY... another user of dependable

Exide-Manchex BATTERIES

Still another forward step in electrical progress! The new Walter C. Beckjord Station, located on the Ohio River, 18 miles upstream from Cincinnati, was designed for an ultimate capacity of 1,000,000 KW. Exide-Manchex batteries furnish the 129-volt control voltage necessary for operating the 2300 and 440 volt auxiliary circuit breakers and auxiliary equipment used in the plant, as well as the 132 kv circuit breakers in the switchyard. The Exide-Manchex control batteries also furnish power potential for alarms, relays, emergency lighting, and miscellaneous requirements.

Exide-Manchex batteries offer better service . . . longer life for these reasons:

POSITIVE OPERATION: Dependable performance at ample voltage with no switchgear failures.

INSTANTANEOUS POWER: High rates for switchgear operation with adequate reserve power for all other control circuits and for emergency lighting.

LOW OPERATING COST: Extremely low internal resistance.

LOW MAINTENANCE COSTS: Water required about twice a year. No change of chemical solution during life of battery.

LOW DEPRECIATION: Sturdy, long-life construction.

GREATER CAPACITY in a given amount of space avoids overcrowding.

★ ★ ★

Various sizes and types of Exide Batteries are available in plastic containers.

Exide-Manchex is your best battery buy for all control and substation services

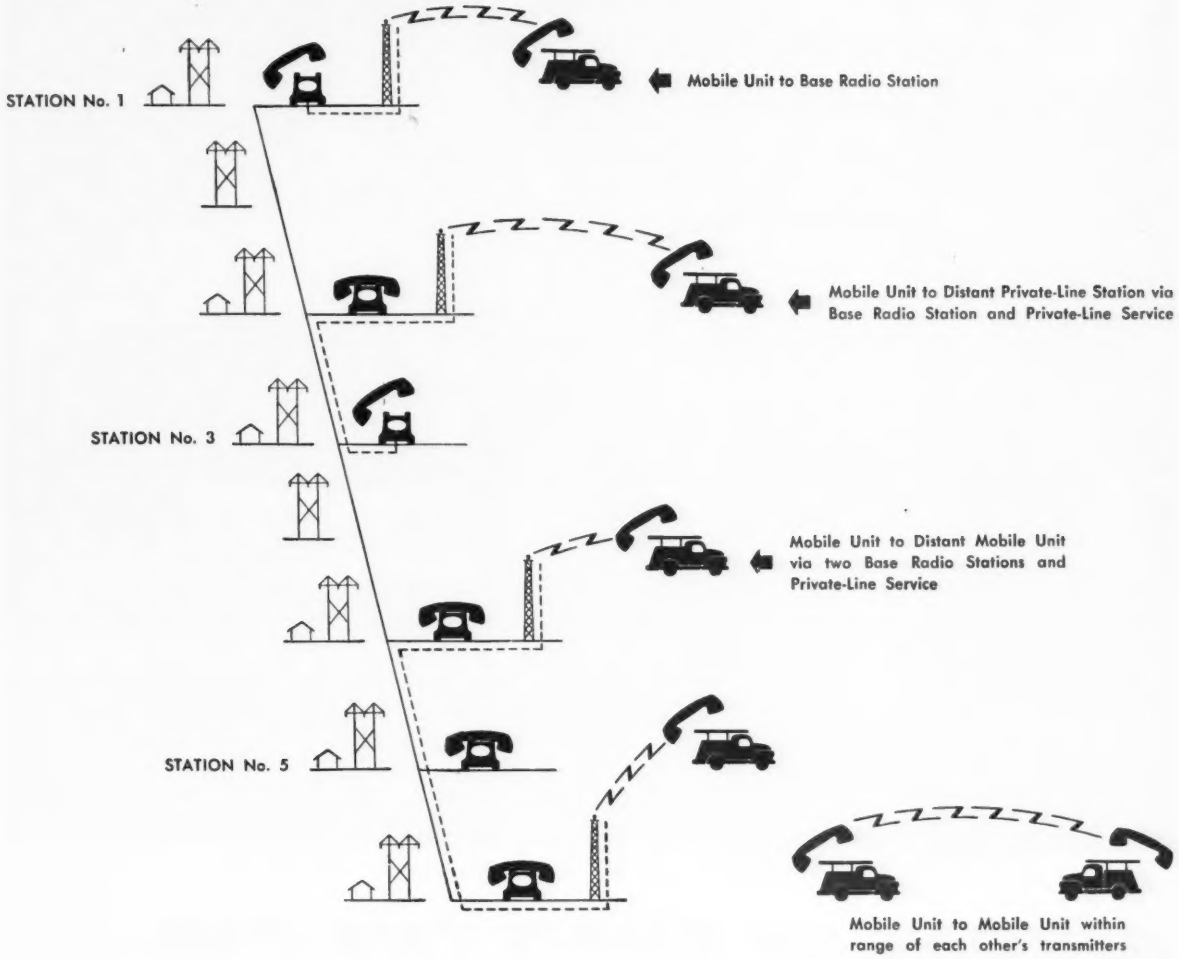
1888... DEPENDABLE BATTERIES FOR 65 YEARS...1953

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 2 • *Exide Batteries of Canada, Limited, Toronto*

"EXIDE" and "MANCHEX" *Reg. T.M. U.S. Pat. Off.*

BELL SYSTEM COMMUNICATIONS

for flexibility all along the line


STATION No. 1
Mobile Unit to Base Radio Station
Mobile Unit to Distant Private-Line Station via Base Radio Station and Private-Line Service
STATION No. 3
Mobile Unit to Distant Mobile Unit via two Base Radio Stations and Private-Line Service
STATION No. 5
Mobile Unit to Mobile Unit within range of each other's transmitters

With integrated mobile radio and private-line telephone service, this Bell System setup is adaptable to many requirements.

Of course, this layout may not fit your particular needs. But Bell System engineers can design one that will. They'll study your operations, then tailor a system to your special requirements.

For Bell System communications you pay a fixed monthly charge—which is complete. It includes continuous maintenance, resources to meet emergencies . . . all the "extras" that would otherwise be your responsibility and expense.

Your Bell Telephone Company will be glad to study your communications problems and needs without charge.

PRIVATE-LINE TELEPHONE

TELETYPEWRITER

MOBILE TELEPHONE

METERING CHANNELS

BELL TELEPHONE SYSTEM

STRONGER THAN THE PIN

In laboratory tests to determine the torsion strength of Kimble *Tempered* Glass Insulators, wood pins were sheared off, and lead-bushed threads stripped, with no failure of the Insulators. Cantilever tests using special alloy pins were discontinued at 10,000 lbs. with still no failure. Ultimate impact tests averaged 130 inch pounds!

Kimble *Tempered* Glass Insulators save installation time because it's never necessary to loosen for lineup with the conductor. Their great strength always allows another quarter-turn.

If it's on the pin, it's in service

Tests far in excess of A.I.E.E. standards have proved it impossible to puncture a Kimble *Tempered* Glass Insulator in air. Even lightning surges have failed to damage them. In the event of shattering due to severe mechanical shock, insulator disintegrates into small, non-sharp fragments. Trouble shooters can locate broken insulator—fast.

What's the secret? *Tempering*, a Kimble development in glass insulators that adds a new element to the many natural virtues of glass insulators. Kimble insulators are more than strong enough to meet the severe tests required.

Why not see how *tempered* glass can cut your line maintenance costs. Write for the new descriptive folder that gives complete details. Address: Kimble Glass Company, Department EW-10, Box 1035, Toledo 1, Ohio.

KIMBLE GLASS COMPANY
Toledo 1, Ohio—*Subsidiary of Owens-Illinois Glass Company*

Simplest Solution

FOR VOLTAGE PROBLEMS...

There is no simpler solution to a voltage problem than an Allis-Chalmers distribution regulator. You get accurate voltage over a narrow ±1 volt band in a unit built for years of satisfactory service. You get easy installation, simple operation, a mechanism with fewer parts than any other on the market, and a control that is simple to maintain. Most important, years of profitable operation in thousands of applications have proved the value of these simple units.

Plenty of Room for Future Expansion

Your system gets plenty of room to grow, thanks to the 20% range of A-C distribution regulators. And installation is so easy that interchange of units costs practically nothing when the time comes for matching greatly increased loads with larger capacity units.

Increase Profits . . . Cut Costs

It's easy to see how system profits increase when distribution regulators are providing ±1 volt regulation. You don't lose revenue during peak loads—or waste power during light loads. In most cases, Allis-Chalmers distribution regulators pay for themselves in less than two years.

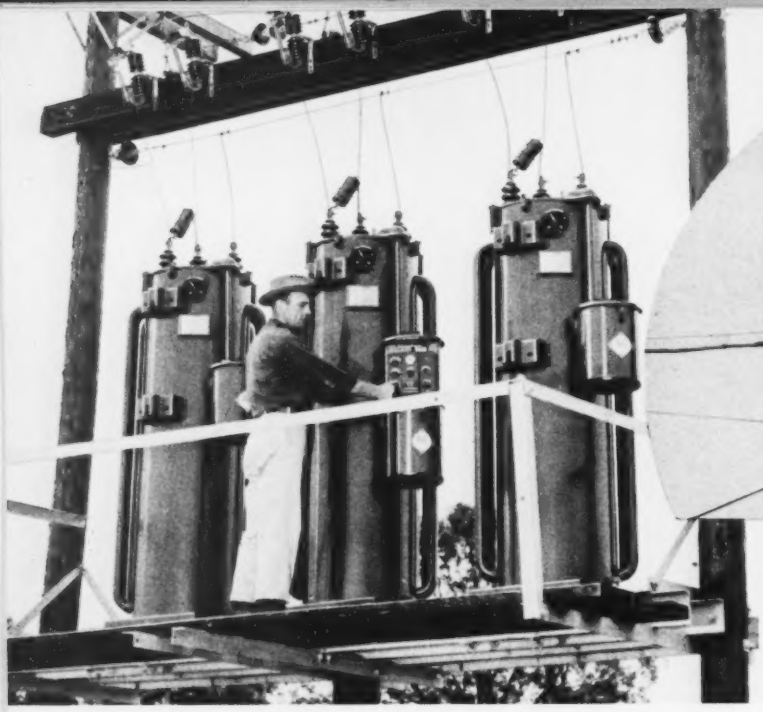
Turn page

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

A-4153

Originators of 5/8% Step Regulation



Only Allis-Chalmers distribution regulators combine convenience of installation and operation with field-proved accuracy and reliability. It will pay to get more facts from your nearby A-C district office or by writing Allis-Chalmers, Milwaukee 1, Wis.

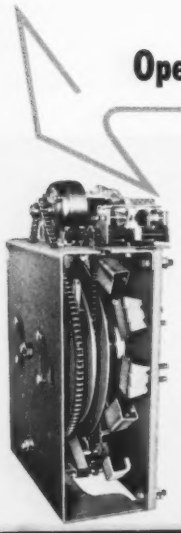
Fast Installation

PLUS SIMPLE OPERATION...

Installing an Allis-Chalmers distribution regulator is easy. Put it on a pole near the load like a distribution transformer or mount it in a substation. Either way, pole or foundation, you save on installation expense. Many users put regulators on platforms suspended between two poles; others mount them two on one pole, the third on the next pole down the line for three-phase regulation near loads.

After your regulator is in place, placing it in operation is equally easy. Careful engineering has made it possible to begin operation after a single adjustment—setting the voltage level. Voltage band is pre-set at the factory for ±1 volt, but it can be changed to a different setting if desired.

Future inspection is especially easy. Thanks to unit construction—exclusive with Allis-Chalmers regulators — you can untank the regulator fast with little trouble. Core and coils are lifted out of the tank as a unit — and the control comes out with them. In fact, you can operate the regulator outside of its tank merely by connecting a separate voltage source to the control — then observing mechanical operation is easy.



Operating Mechanism Has Fewer Parts Than Any Other

THE HEART OF A STEP-TYPE REGULATOR is its tap-changing mechanism. In all Allis-Chalmers regulators you get the proved advantages of the *Quick-Break* mechanism. No other tap changer on the market can equal its simplicity, ruggedness, and reliability. Laboratory tests have proved that it can withstand five million operations—equivalent to 100 years of normal service. Field operation during the past twenty years on all types of regulators has proved its value in actual operation. The *Quick-Break* mechanism is one of the most important reasons why you can depend on Allis-Chalmers distribution regulators to add to system profits for years and years after increased profits have paid off the original investment.

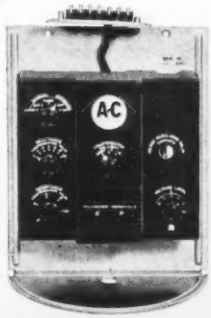
You Get These Important Features

- ± 1 volt band.
- 20% range of regulation.
- *Quick-Break* Tap-Changing Mechanism—simplest on the market.
- *Feather-Touch* controls for accuracy and easy maintenance.
- Long-Life Contacts—good for two million operations.
- Unit construction for easy routine maintenance.
- Proof of performance, thanks to nine years of successful field operation.

RATINGS AVAILABLE	14,400 Volts — 50, 100 amp 7620 Volts — 15, 50, 100 amp 5000 Volts — 50, 100 amp 2500 Volts — 100, 200 amp

Control Is Example of SIMPLE MAINTENANCE

FEATHER-TOUCH controls—standard on all A-C 5/8% step regulators — offer extreme simplicity in maintenance as well as accuracy and reliability. If a control should need checking, it's a simple matter to remove and replace it because a single jack plug connects all wiring to the regulator. There are no connections to break, no wires to code. Just pull the single jack plug and replace the control with a spare — then the original control can be returned to the shop to be serviced. You save because linemen don't have to be highly trained technicians; experienced servicemen can spend their time working in the shop on other equipment, not wasting time driving to distant locations and climbing poles.

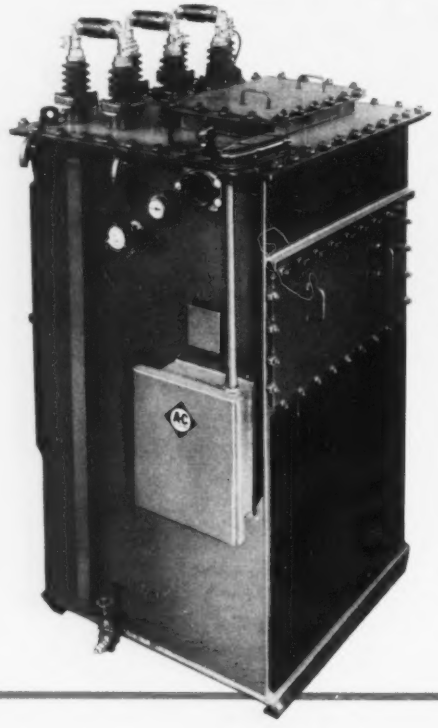


Complete Line

MAKES MAINTENANCE SIMPLE...

In addition to the low-cost distribution regulator, you can get either single- or three-phase station-type regulators from Allis-Chalmers complete line of 5/8% step voltage regulators. Since all the important features of A-C regulator design are common to all three units, you simplify your maintenance problems when your system is completely Allis-Chalmers equipped. Training servicemen is easier because there is only one principle of operation to be learned. And maintenance is simple because each regulator is equipped with the same basic advantages — like *Feather-Touch* control and the *Quick-Break* tap-changing mechanism. It pays to depend on Allis-Chalmers experience in design and manufacture of voltage regulators. Get more information from your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

ALLIS-CHALMERS
5/8% STEP VOLTAGE REGULATORS



Station-type, single-phase regulator in sizes from 2400 to 6900 volts, 12 to 250 kva. Brings all the advantages of A-C 5/8% step regulation plus the *Vari-Amp* feature, which provides five current ratings instead of two as on other types of station-type regulators.

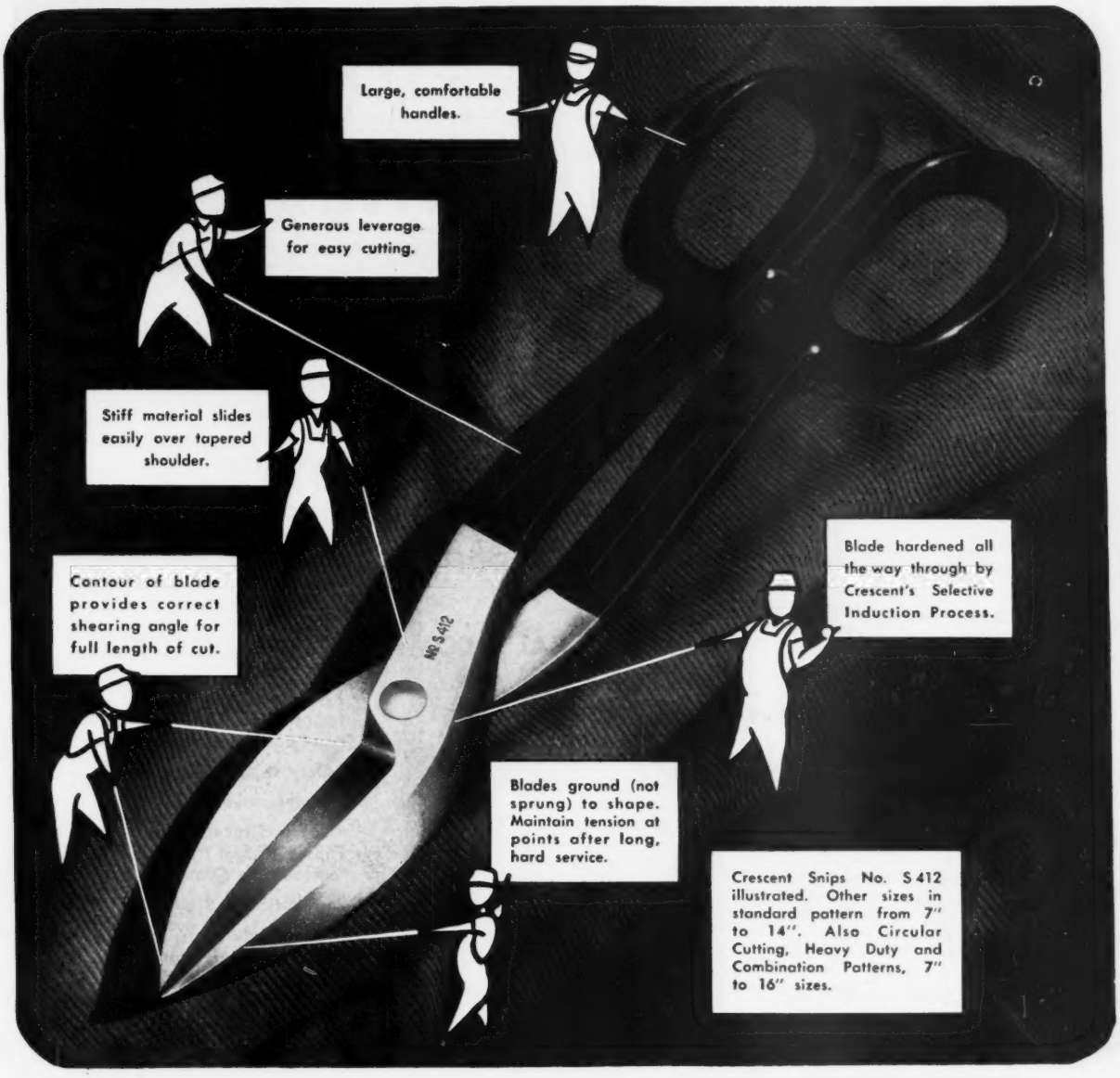
Station-type, three-phase regulator in sizes through 69 kv, 2500 kva. This is the original 5/8% step regulator for three-phase service.

ALLIS-CHALMERS

A-C ALLIS-CHALMERS

Originators of 5/8% Step Regulation

Why Craftsmen prefer CRESCENT SNIPS


Large, comfortable handles.
Generous leverage for easy cutting.
Stiff material slides easily over tapered shoulder.
Contour of blade provides correct shearing angle for full length of cut.
Blade hardened all the way through by Crescent's Selective Induction Process.
Blades ground (not sprung) to shape. Maintain tension at points after long, hard service.
Crescent Snips No. S412 illustrated. Other sizes in standard pattern from 7" to 14". Also Circular Cutting, Heavy Duty and Combination Patterns, 7" to 16" sizes.
No S412

● All Crescent Snips are forged of selected steel and blades ground on special grinding machines. They are hardened by Crescent's own selective induction process to insure long satisfactory service. These easy-cutting, well-balanced snips are made in four patterns; standard, circular cutting, combination and heavy duty. Sold by hardware dealers everywhere.

CRESCENT TOOLS
Give Wings to Work
®
Sign of the Artisan
Symbol of Excellence

Crescent is our trade-mark, registered in the United States and abroad, for wrenches and other tools. Sold by leading distributors and retailers everywhere and made only by

CRESCENT TOOL COMPANY, JAMESTOWN, NEW YORK

PYLE-NATIONAL

SERVICE ENTRANCE

PYLETS

Entrance Heads

HEADS, CAPS, ELBOWS AND CONNECTORS

FORMERLY MANUFACTURED BY THE M. B. AUSTIN COMPANY

Another important addition to an extensive and continuously expanding line of high quality, heavy duty wiring and lighting products.

PYLE-NATIONAL'S COMPLETE LINE INCLUDES:

Cable Clamp Caps · Entrance Caps · Cable End Fittings · Conduit End Fittings

Two-Screw Connectors · Hexagon-Nut Connectors · Entrance Elbows · Grounding Elbows

Sill Plates · Floor Plates · Corner Elbows · Capped Elbows

- Pylet conduit fittings for hazardous and non-hazardous locations.
- Safety switches.
- Circuit breakers.
- Plugs and receptacles, Triploc, Midget Triploc, Quelarc and Strate-Line.
- Push-button and pilot light Pylets.
- Lighting fixtures, explosion-proof, dust-tight, vapor-tight.
- Junction Pylets.
- Conduit unions.
- Cord and cable sealing grips.
- Floodlights and pit lights.
- Loading lights.
- Gyralite visual warning signals.

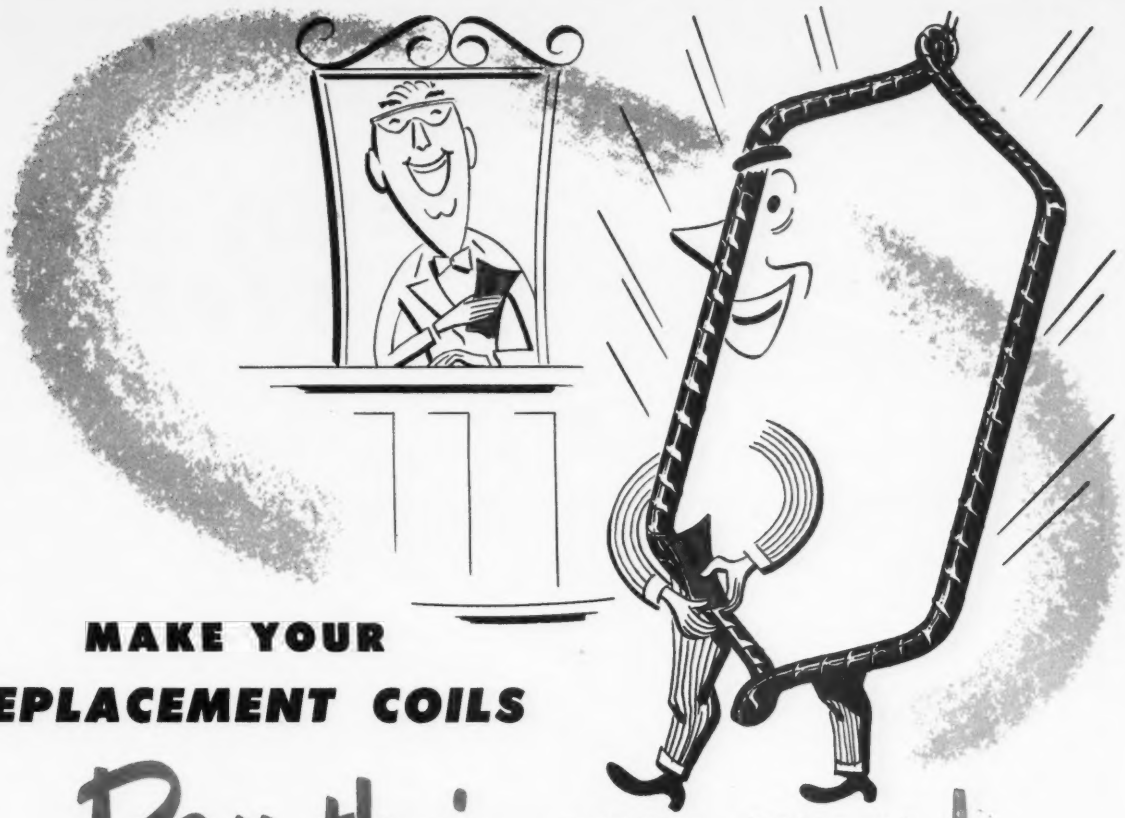
Refer to Bulletin 1135 for complete listings... or call your Pyle-National Electrical distributor.

SINCE 1897

THE PYLE-NATIONAL COMPANY

1334 NORTH KOSTNER AVENUE, CHICAGO 51, ILLINOIS

DISTRICT OFFICES and REPRESENTATIVES in Principal Cities of the United States
EXPORT DEPARTMENT: International Railway Supply Co., 30 Church St., New York
CANADIAN AGENT: The Holden Co., Ltd., Montreal



MAKE YOUR REPLACEMENT COILS Pay their own way!

An electro-metalurgical producer is drawing a large annual power bonus because National maximum-capacity design boosted the capacity of his generator by 15.9 per cent. Increased output will pay for the complete rewinding job in a little more than two years.*

"As good as new" is *not* good enough for National. A generator or motor with National replacement windings *must be better than new.* Every phase of National engineering and production is directed toward this objective.

Redesign for maximum capacity is typical of extras you can count on from National. Where increased output can be used or sold, National replacement windings will pay for themselves over a very short period of time. Where it cannot be utilized, extra capacity reduces operating temperatures and results in substantially longer coil life.

If you operate heavy rotating electrical equipment for any purpose, you can operate it more profitably with National windings. Get in touch with your nearby National field engineer today. Find out how National maximum-capacity design and National extra-quality coils can help your motors and generators do a better job.

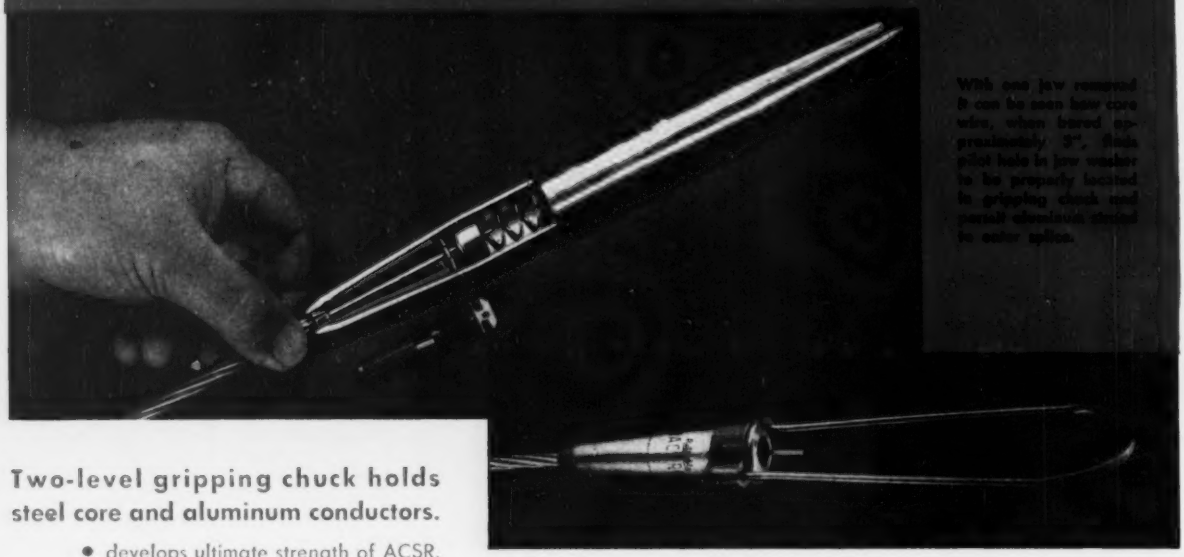
*Complete details on this installation available on request.

NATIONAL ELECTRIC COIL COMPANY

COLUMBUS 16, OHIO, U. S. A.

ELECTRICAL ENGINEERS: MAKERS OF ELECTRICAL COILS AND INSULATION—
REDESIGNING AND REPAIRING OF ROTATING ELECTRICAL MACHINES

NEW Reliable PILOT CUP TYPE "STRAIGHTLINE" SPLICE *for* ACSR



Two-level gripping chuck holds steel core and aluminum conductors.

- develops ultimate strength of ACSR.
- makes an electrical connection of low resistance at minimum tensions.

DEADEND IS OF SAME DESIGN A straightline deadend for ASCR is assembled to conductor following same instructions as for splice. Only the steel core wire feeds thru. Deadend bail is stainless steel.

features:

1. Pilot cup in each end of the splice permits bared steel core to run thru core gripping area.
2. Pilot cup then caps aluminum strands to guide them to their proper location in the gripping chuck. Aluminum strands cannot enter the splice unless core wire is first properly located.
3. Bent or out-of-lay strand or burred conductors cannot catch in the jaws. They are refused or covered by the pilot cup. If they go in the pilot cup they are guided through the jaws and are properly located.
4. Splices and deadends are grease packed and packaged in plastic. All working parts and all surfaces are factory coated with corrosion inhibitor No-Oxid oil.

Write for new bulletin giving complete information. Reliable will gladly give you a demonstration — simply ask for it on your company letterhead.

Reliable **ELECTRIC COMPANY**

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CHICAGO 12, ILLINOIS

OVER 45 YEARS OF SERVICE TO THE UTILITIES

POWER-LINE CONNECTORS and CONSTRUCTION SPECIALTIES

Durasheath: saves needless power-line jointing

Why complicate cable installations by shifting from buried to duct or aerial types in industrial plant feeder lines? Flexible, easily handled DURASHEATH* Cable can cut your costs. You can run this tough, versatile cable underground directly in the earth, overhead or in ducts (or in any combination) without needless, time-consuming jointing. Its light weight and flexibility make duct pulling fast even in zero weather. Aerial assemblies go faster. Linemen like to work with it. You stock only one cable type – all-purpose DURASHEATH.

* * *

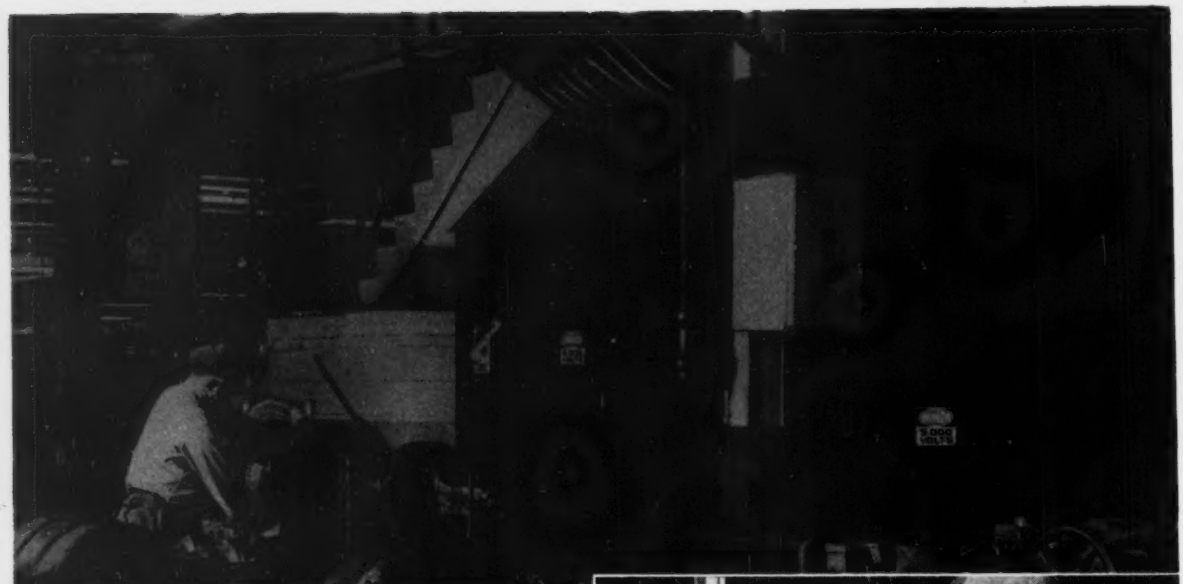
As one of several types of ANACONDA power cables, DURASHEATH is available in all sizes, single or multiconductor, copper or aluminum, from 600 to 15,000 volts. It is thoroughly dependable for industrial plants, railroads, series or multiple street lighting, airport† lighting, residential primaries and secondaries, as well as for such uses as Type USE cable for underground service entrance. *Anaconda Wire & Cable Company, 25 Broadway, New York 4, N. Y.*

*Reg. U. S. Pat. Off. 53312

ANACONDA®

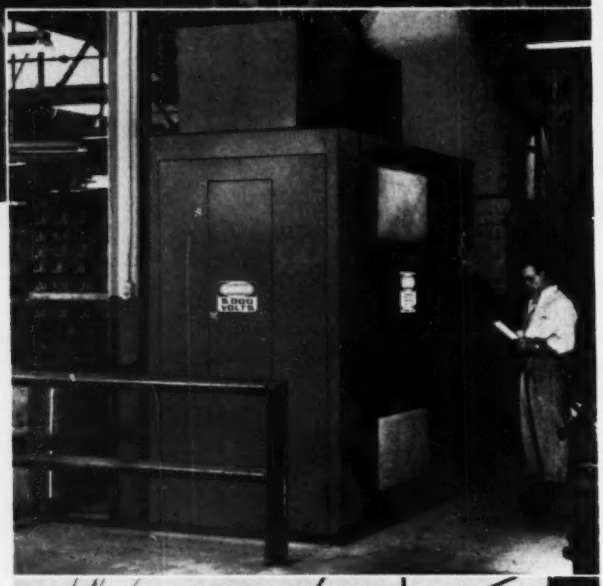
Primary and secondary distribution cables • building, machine tool, control and communication wire • portable cords and cables • bus-drop cables • apparatus cables • copper, aluminum, copperweld conductors • wire and cable accessories.

†*When ordered to CAA Specification L-824*



POWER...

Above—one of the two 2,000 KVA unit sub-stations powered by an Uptegraff Dry Type Transformer, located near the assembly line.



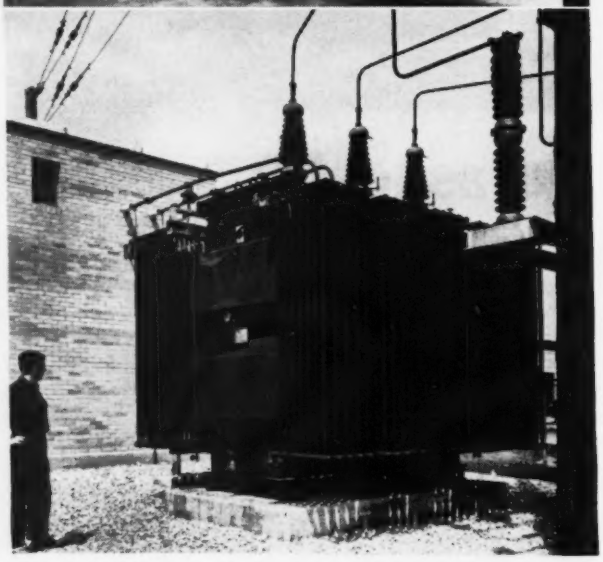
where and as needed . . .

with

UPTEGRAFF

transformers

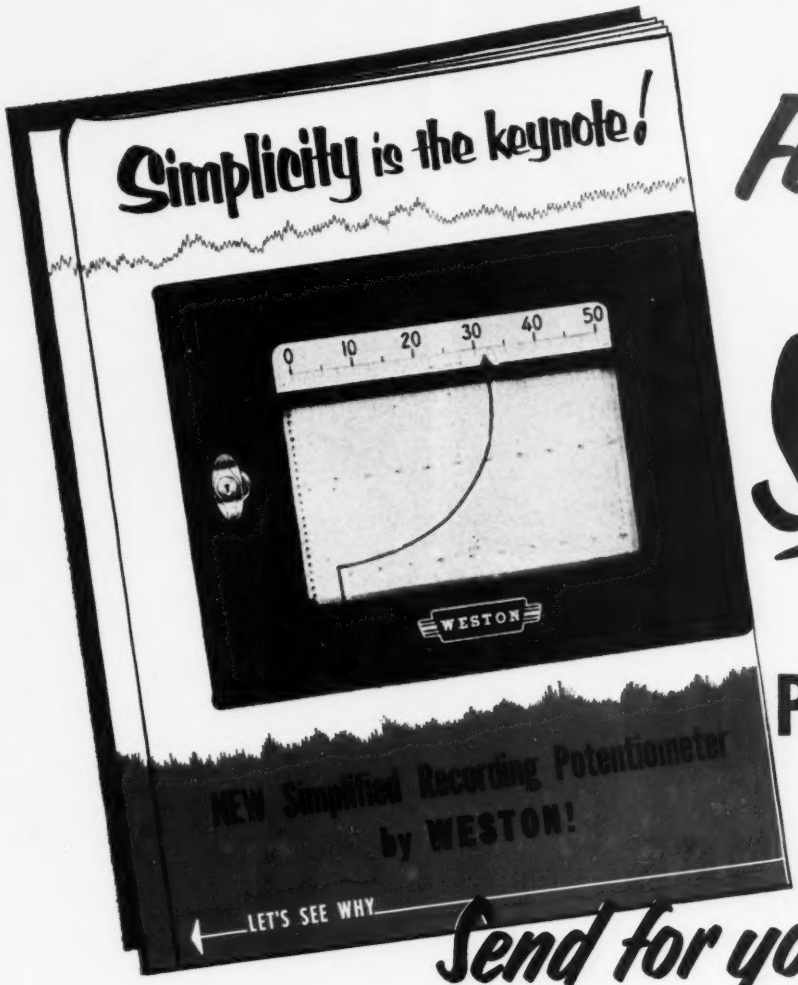
Located close to the center of their electrical loads, the Uptegraff Dry Type Transformers shown here serve efficiently in the Newark, Ohio plant of the Ohio Gear and Axle Division of Timken-Detroit Axle Company. Line losses are reduced by the central location of the transformers, and power characteristics are improved. In this plant are two 2000 KVA and two 1000 KVA dry type Uptegraff Transformers. Supplying these indoor dry type Uptegraff transformers is a 6000 KVA oil-cooled Outdoor Power Transformer.



R. E. Uptegraff Manufacturing Co.

Scottdale, Pennsylvania

6000 KVA Uptegraff Outdoor Power Transformer supplying the entire plant is shown at the right.



Full Data on the new Simplified Recording Potentiometer

Send for your copy!

This booklet unfolds the complete story of the recording potentiometer that has been acclaimed by instrument men everywhere for its unequalled versatility, accuracy, long-term dependability, and its *unit design* which makes servicing so simple and quick.

With fewer components . . . with all assemblies greatly simplified and quickly interchangeable . . . with all adjustments including range changes made quickly on the line . . . with new ruggedness to withstand vibration, shock and usual plant abuse . . . it has set new standards for sustained accuracy, and for economy in servicing and maintenance.

This new WESTON Simplified Recording Potentiometer can be used to measure and record temperature, d-c current, d-c voltage, resistance, a-c voltage, a-c current, speed, speed ratio, power, frequency, hydrogen ion (pH), light intensity or any other quantity that can be converted into electrical values. The whole story is available in this booklet. Send coupon for your copy today. WESTON Electrical Instrument Corporation, 614 Frelinghuysen Avenue, Newark 5, New Jersey.

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WESTON ELECTRICAL INSTRUMENT CORPORATION
614 Frelinghuysen Avenue
Newark 5, New Jersey

Send a copy of the booklet describing the WESTON Simplified Recording Potentiometer to:

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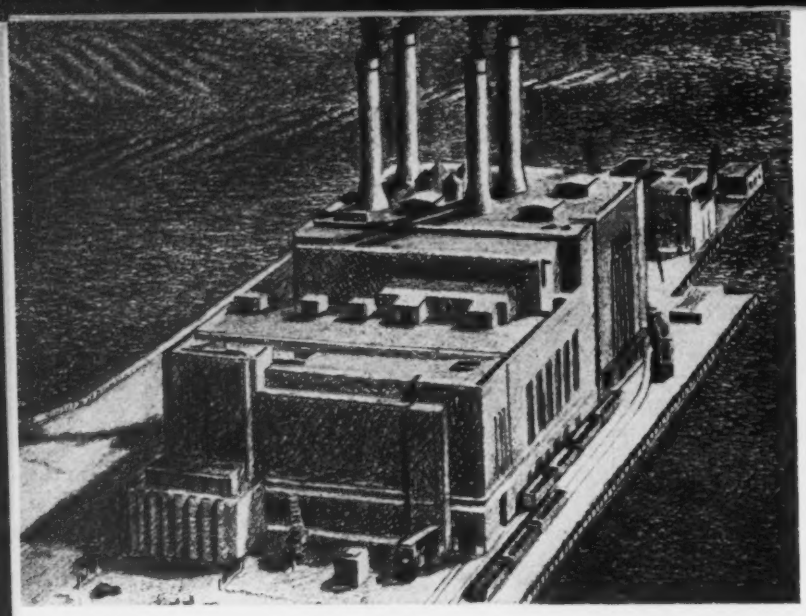
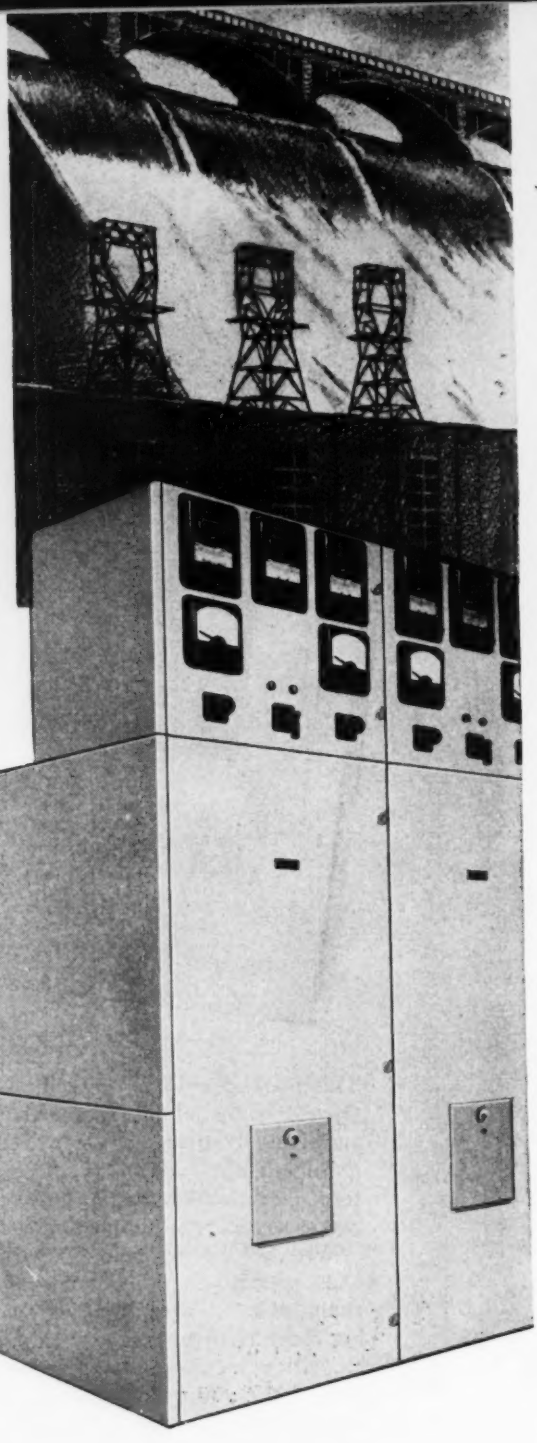




A TRILLION KWHR by 1965*

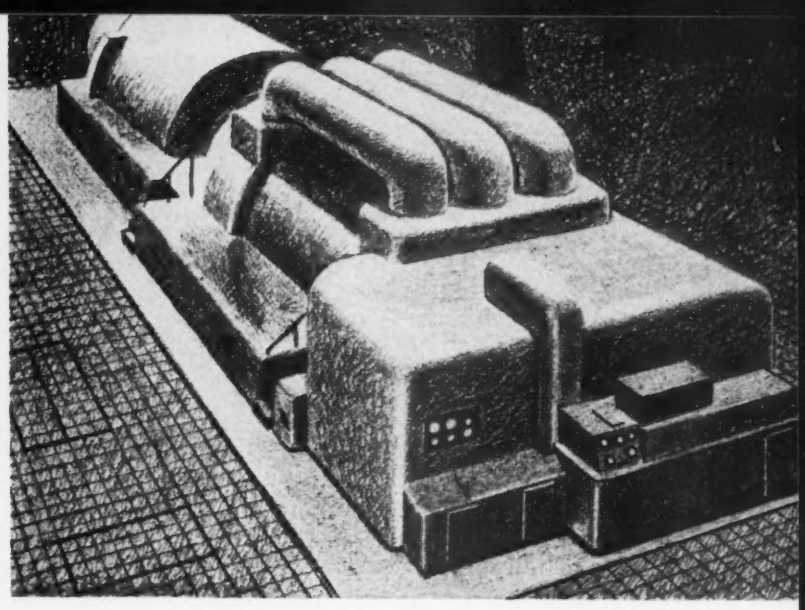
I-T-E is pacing America's greatest electrical expansion

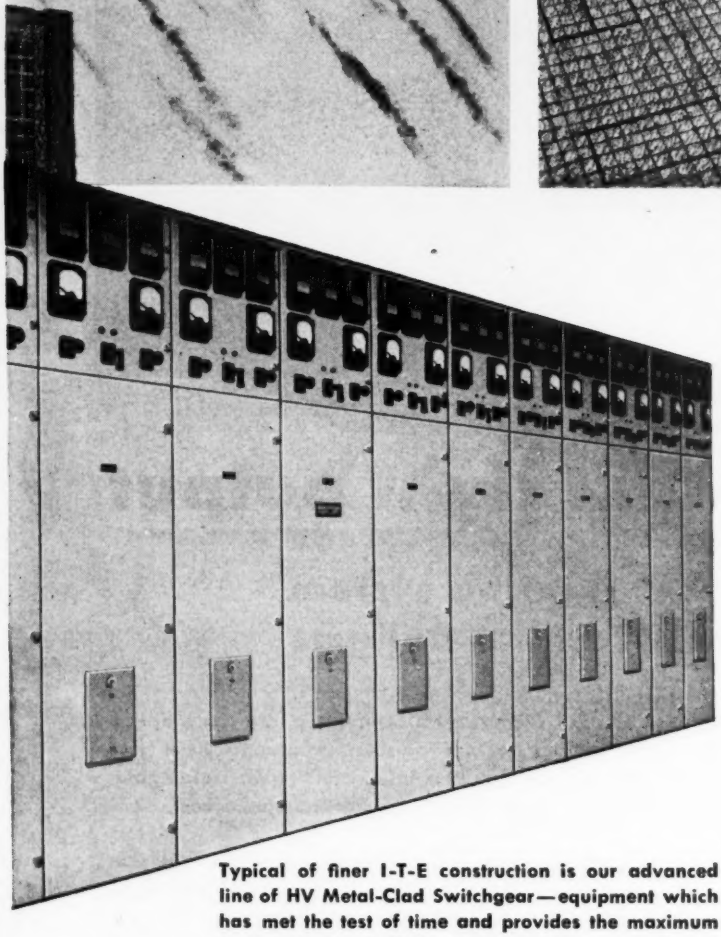
KWHR capacity has doubled in the past ten years and present trends indicate another doubling in the decade to come. New power generation, transmission, and distribution equipment—more of everything—will be required to handle this increased capacity.

In the past ten years, I-T-E has expanded some twenty fold—supplying quality switchgear for every type of industrial and commercial application. Look for even bigger strides forward—broader lines, more products, finer designs, and increased production—as I-T-E continues to pace America's greatest electrical expansion.

**Edison Electric Institute*

THE SYMBOL OF QUALITY SWITCHGEAR





Typical of finer I-T-E construction is our advanced line of HV Metal-Clad Switchgear—equipment which has met the test of time and provides the maximum in protection and efficiency at a minimum over-all cost.

For details, call the I-T-E field office nearest you. Look in your classified telephone directory under "Electrical Equipment."

Or—write for **Bulletin No. 7004B.**

I-T-E Switchgear embodies...

- advanced engineering
- refined design
- quality construction

Through 65 years, the I-T-E Circuit Breaker Company has achieved outstanding recognition in the industry by persistent effort to advance the switchgear art.

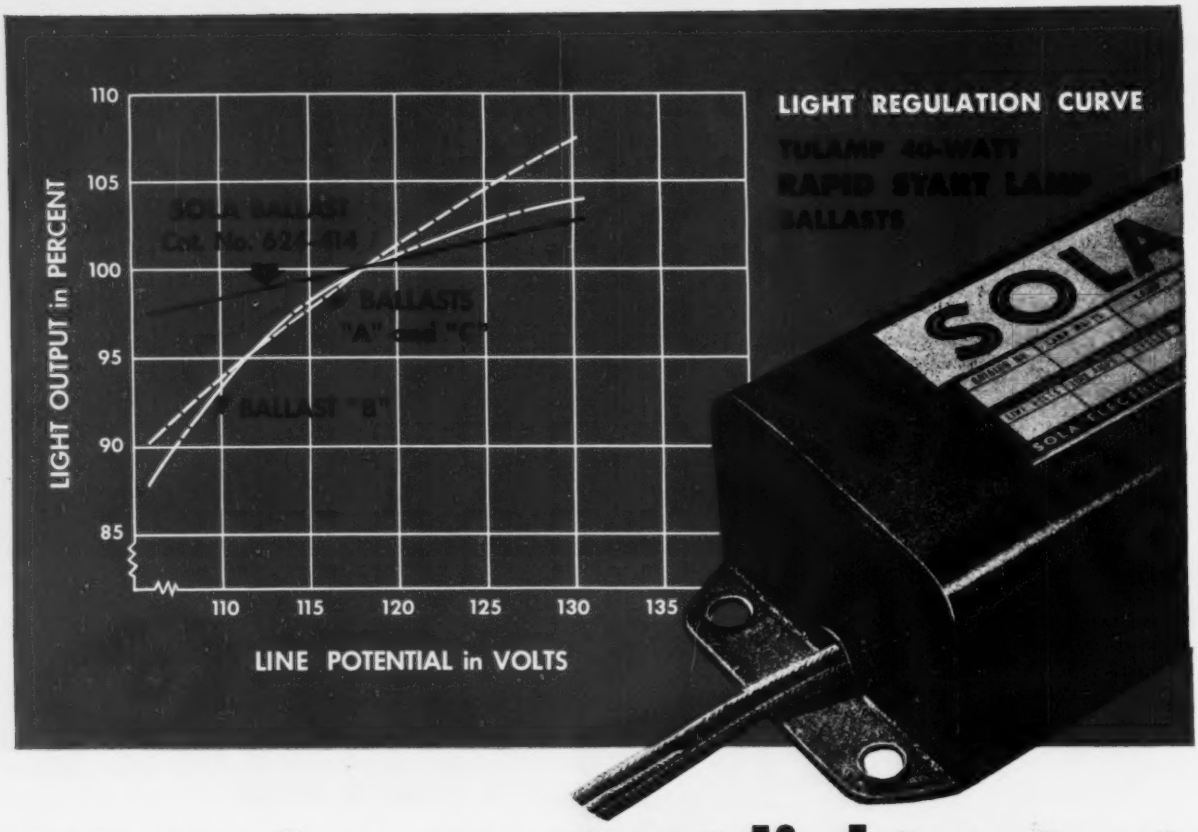
Many switchgear "firsts" are attributed to I-T-E, among them:

- the original Inverse Time-Element (I-T-E) circuit breaker
- the first enclosed circuit breakers and switchboards
- the first high-voltage air magnetic circuit breaker
- the first isolated-phase bus

In addition to the introduction of new ideas and thinking, I-T-E has devoted its engineering skill to accomplishing the ultimate in design and production refinement.

I-T-E Circuit Breaker Co., 19th and Hamilton Sts., Philadelphia 30, Pa.

I-T-E Metal-Clad Switchgear



guarantee constant light output

from your rapid start lighting system with SOLA Constant Wattage Ballasts

You design your rapid start lighting system to deliver a specific number of foot candles at a specific working surface. Your *customer* buys your system on the basis of that expected performance . . . but what happens to light output when line voltage varies? With ordinary unregulated ballasts lumen output and efficiency will drop significantly with line voltage . . . with Sola Constant Wattage Ballasts lumen output will be maintained within ±2.5% or less with line voltage variations as great as ±10%.

In addition to maintained light output Sola Constant Wattage Ballasts for rapid start lamps offer many additional advantages: long lamp life, cool operation, self protection against damaging heat rise when lamps fail, absolute safety when relamping, unusually quiet operation, low purchase cost.

You automatically guarantee all the light you proposed when your installation is ballasted with Sola Constant Wattage Ballasts. You guarantee your customer's satisfaction through continuous, dependable performance. Write for full information, or request a Sola sales engineer to call and give you all the illuminating facts.

SOLA *Fluorescent* **BALLASTS**

WRITE FOR RAPID START BALLAST BULLETIN ZFL-191

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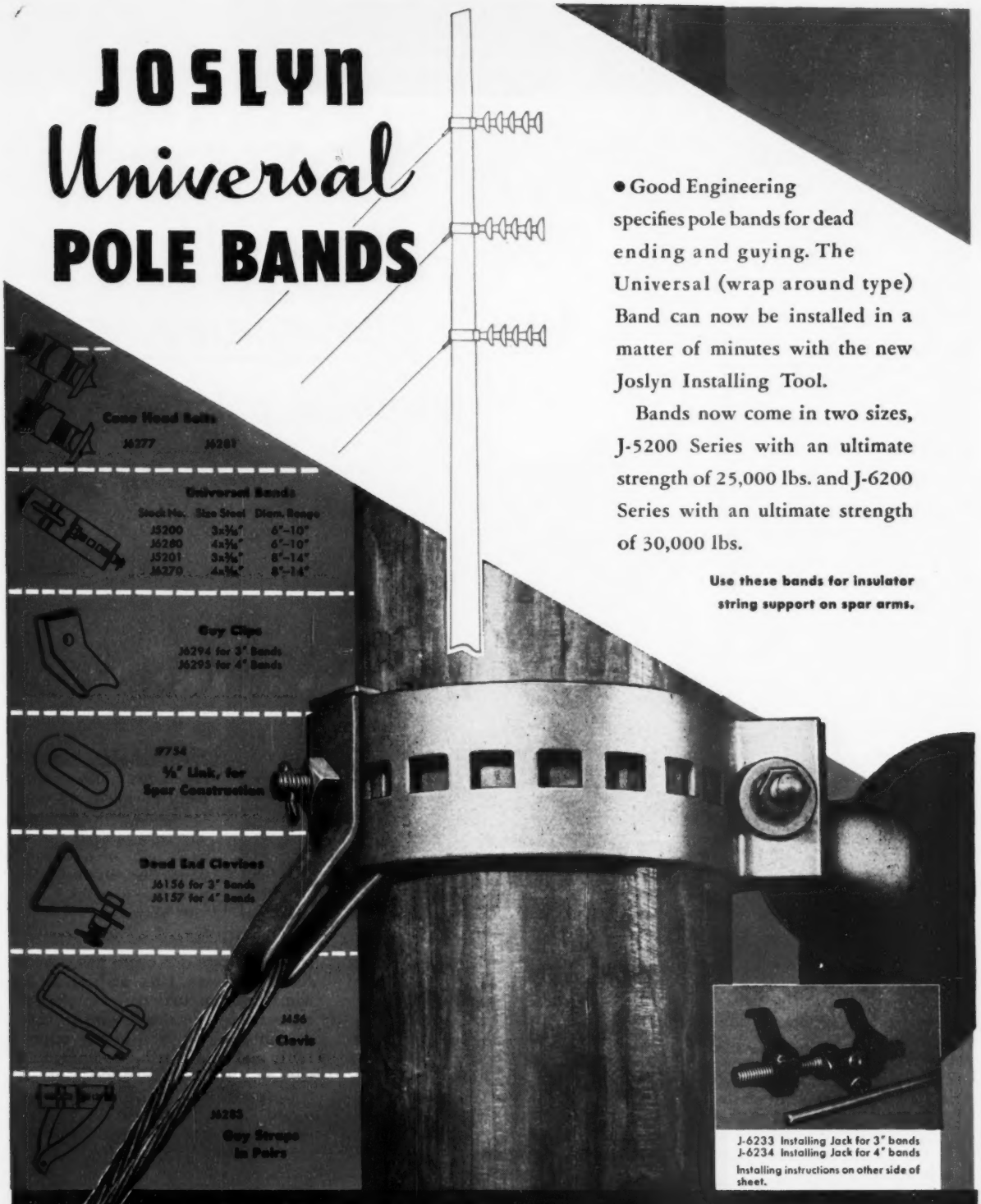
PHILADELPHIA, Commercial Trust Bldg., Rittenhouse 6-4988 • BOSTON, 272 Centre St., Newton 58, Mass., Bigelow 4-0322
CLEVELAND 15, 1836 Euclid Ave., Prospect 1-4600 • KANSAS CITY 2, MO., 306 W. 24th St., Jefferson 4367 • Representatives in Principal Cities

JOSLYN Universal POLE BANDS



• Good Engineering specifies pole bands for dead ending and guying. The Universal (wrap around type) Band can now be installed in a matter of minutes with the new Joslyn Installing Tool.

Bands now come in two sizes, J-5200 Series with an ultimate strength of 25,000 lbs. and J-6200 Series with an ultimate strength of 30,000 lbs.

Use these bands for insulator string support on spar arms.

J-6233 Installing Jack for 3" bands
J-6234 Installing Jack for 4" bands
Installing instructions on other side of sheet.

JOSLYN Mfg. and Supply Co.

Branch Offices in Principal Cities

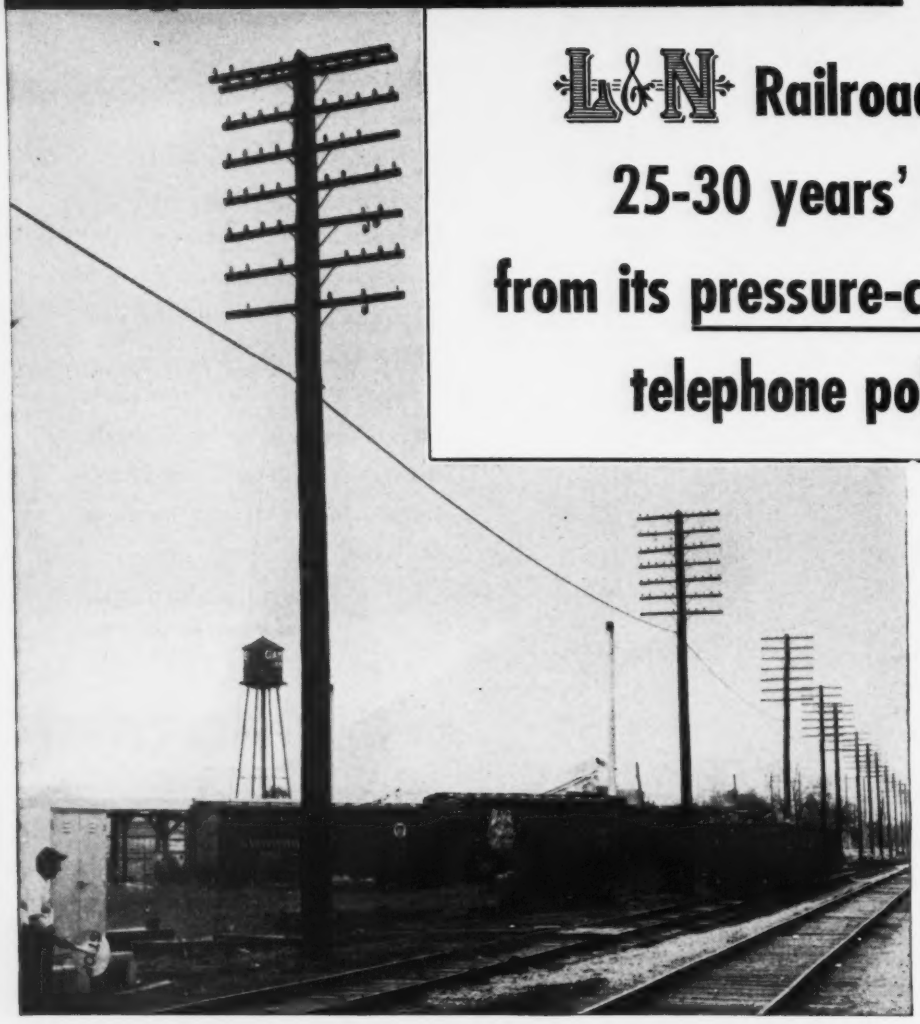
Complete Line Equipment

20 North Wacker Drive, Chicago 6, Ill.

The Joslyn Co. • The South East Joslyn Co. • Southern Joslyn Co. • Joslyn Southwest Co. • Joslyn Pacific Co.

Here's Proof of Performance...

L&N Railroad gets 25-30 years' life from its pressure-creosoted telephone poles



EVERY ONE of the pressure-creosoted poles in this picture has been in service for more than 25 years. The poles carry the L&N's privately-owned telephone line, paralleling the main line near the Louisville Terminal.

Coordinating its operations by means of 4,332½ track miles of privately-owned telephone line, the Louisville & Nashville Railroad relies almost entirely on pressure-creosoted poles. For good reason, too, because the service records of creosoted poles are outstanding, in spite of high annual temperatures and average amount of precipitation.

J. B. Hitt, Telephone Engineer, L & N Railroad, says:

"We are getting approximately 25 to 30 years of life from creosote poles. A very small percentage of poles set in past 25 years have had to be replaced on account of being defective."

The L & N began using pressure-creosoted southern yellow pine poles back in 1924 and today has nearly 175,000 in service. Poles are pressure-creosoted in the railroad's own plant at Gautier, Mississippi.

For long-term protection of wood—poles, crossarms, crossties, posts, lumber and timber—against termites and decay due to fungi and marine borers, Creosote has proved its effectiveness time and again. It combines the toxicity and permanence needed for effective protection.

Uniform quality is highly important, and you can be assured of it when U·S·S Creosote is used. It is the product of continuous processing in America's largest tar distillation plant. For complete information, contact our nearest Coal Chemical sales office or write to United States Steel Corporation, 525 William Penn Place, Pittsburgh 30, Pa.

U·S·S CREOSOTE

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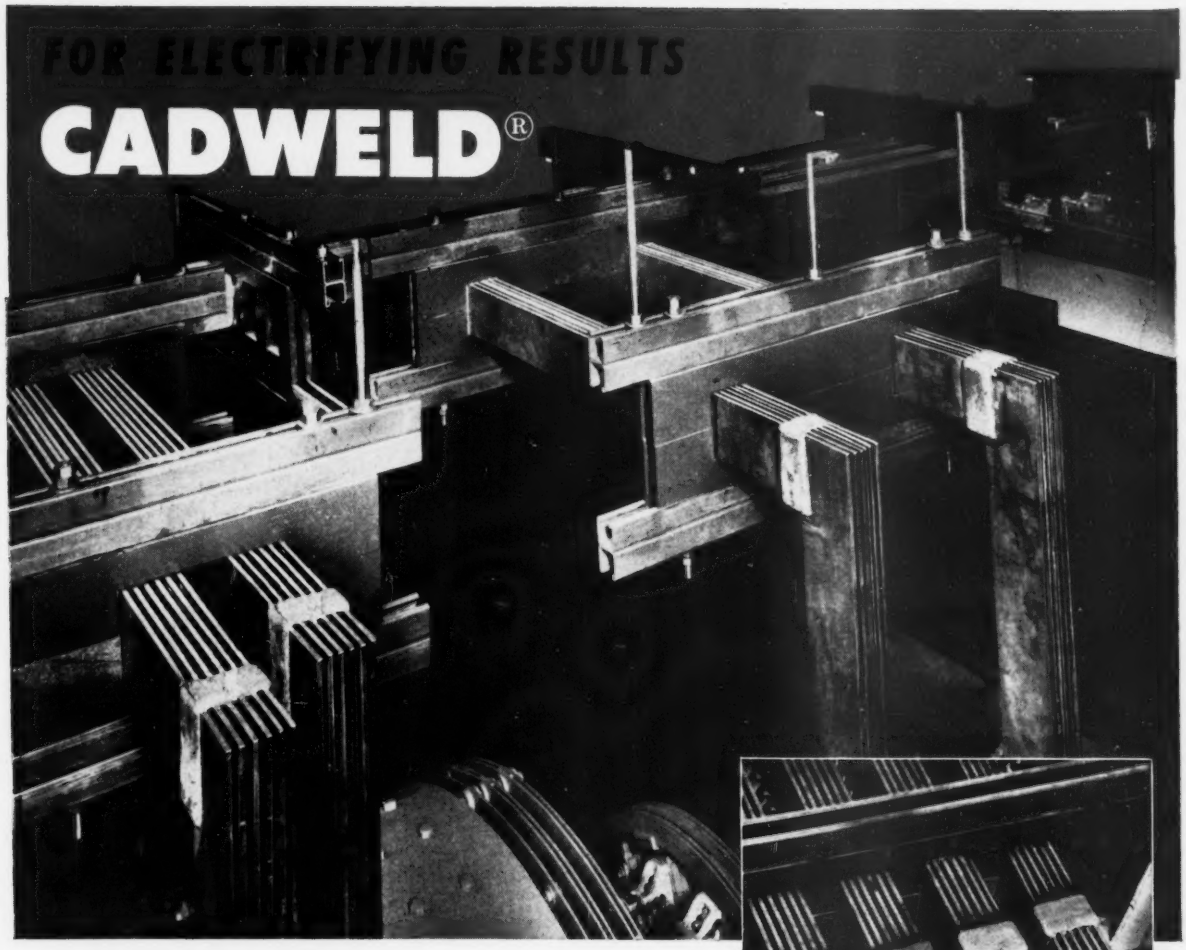
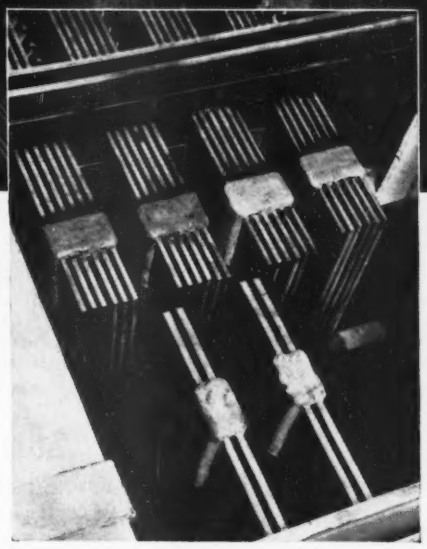
UNITED STATES STEEL

FOR ELECTRIFYING RESULTS

CADWELD®





HAMILTON STANDARD DIVISION of UNITED AIRCRAFT CORPORATION installs main feeder bus for plating tanks with CADWELD. Six ¼" x 4" busbars welded at one time by the CADWELD PROCESS insure 100% performance as connections cannot LOOSEN or CORRODE.

For the best in electrical connections—specify CADWELD.

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NATVAR *in* NORWAY

This secondary coil shows the rugged construction used to insure proper operation under all service conditions. Natvar Varnished Fiberglas Tape and Sleeving are used to insulate and protect coils and leads from moisture and heat.

This UNITOR AC Arcwelder provides a welding current of 600 amperes at 40 volts load voltage on a 50% duty cycle. Heat range can be controlled either at the unit or from the operator's stand, from maximum down to 100 amperes at 25 volts. The unit can be moved close to the job so that long ground and electrode cables are not required.

UNITOR A. S., Oslo, Norway, manufactures a complete line of AC Arcwelders which can be easily moved from job to job. Since service conditions vary widely, these units are designed and built to operate in spite of severe moisture, corrosion, heat, and vibration.

Transformer coils and leads are insulated and protected with Natvar Varnished Fiberglas Tape and Sleeving because of its uniformly high performance under adverse conditions. Natvar agent and distributor for Norway is C. Bagges Asbestkompani A.S., Radhusgt 6, Oslo.

If you need insulating materials with good physical and electrical properties, and exceptional uniformity, it will pay you to get in touch with your distributor, or with us direct.

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FORMERLY THE NATIONAL VARNISHED PRODUCTS CORPORATION

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Natvar Products

- Varnished cambric—cloth and tape
- Varnished canvas and duck
- Varnished silk and special rayon
- Varnished—Silicone coated Fiberglas
- Varnished papers—rope and kraft
- Slot cell combinations, Aboglas®
- Varnished-lacquered tubing and sleeving
- Extruded vinyl tubing and tape
- Styroflex® flexible polystyrene tape
- Extruded identification markers

Ask for Catalog No. 22

In electrical installations *where QUALITY counts* use CONDULETS*

Quality does count in practically every electrical conduit installation that you make. When you use CONDULETS you know that you are putting in electrical equipment of the highest quality, because CONDULETS have been doubly tested . . . in the factory and in the field.

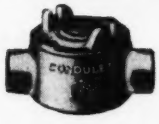
Crouse-Hinds quality control assures a long-lasting product and field records prove it by the test that only time can give. Thousands of CONDULET installations are still in tip-top condition after twenty, thirty, or even more than forty years of dependable service.

The illustration at the right shows four of Crouse-Hinds' basic quality features that are common to all CONDULETS. The fifth, Wedge Nut Fasteners, is an exclusive Crouse-Hinds feature that has made Obround CONDULETS preferred by electricians everywhere.

Type EVA Explosion-Proof Lighting Fixture

Type ARE Arktite Receptacle Equipment

Type FS Condulet With Pilot Lamp Receptacle, Switch and Plug Receptacle



Type GUAC Explosion-Proof Junction Condulet

1. **Taper tapping.** Condulet threads are taper tapped to match tapered conduit threading. Makes a rigid joint that will not loosen. This assures permanent ground continuity . . . important for safety.
2. **Integral bushing.** A smooth rounded surface protects wire insulation.
3. **Material.** Feraloy . . . a special alloy that is strong and tough, resists corrosion, and gives sharp, full threads
4. **Finish.** A triple treatment provides long-lasting protection . . . exceeds Federal and U. L. specifications.
5. **Wedge Nut cover fastener.** Clear cover opening . . . no projections. No loose parts . . . Wedge Nuts and screws self-retained. No screw holes to align.

More than 15000 items are listed in the Condulet Catalog including a complete explosion-proof and dust-tight line for use in hazardous locations.

On your next job, use CONDULETS . . . they're made right to last longer.

**CONDULET is a coined word registered in the U. S. Patent Office. It designates a product made only by the Crouse-Hinds Company.*

Type VC Vaportight Industrial Lighting Fixture

Type FLB Explosion-Proof Circuit Breaker Condulet

Type EPC Explosion-Proof Motor Starter and Circuit Breaker Condulet

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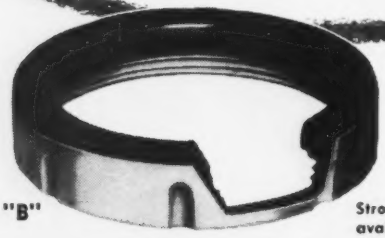
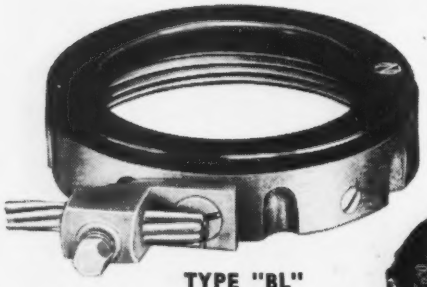
CONDULETS · TRAFFIC SIGNALS · AIRPORT LIGHTING · FLOODLIGHTS

THERE'S AN O.Z. BUSHING FOR EVERY JOB



TYPE "B"

Strongest insulating bushing available! Exclusive design permanently locks insulation into casting.



Same as proven Type "B" with lug for quick, positive ground connections. Set screw in casting facilitates positioning.

TYPE "BL"

Finest, high-strength, all-Bakelite insulating bushing. A top quality bushing—competitively priced!

All-Bakelite bushing with male thread for insulation of exposed cables passing through holes in metal boxes or troughs.

TYPE "A"

TYPE "BB"

Over 35 years of specialized experience in the design and manufacture of conduit fittings is behind the complete line of O.Z. insulating bushings. Whatever your insulating bushing problem, you can be sure there is an O.Z. design to fit your application perfectly. Buy O.Z. bushings from your local electrical distributor.

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CAST IRON BOXES • SOLDERLESS CONNECTORS
CABLE TERMINATORS • GROUNDING DEVICES
POWER CONNECTORS • CONDUIT FITTINGS

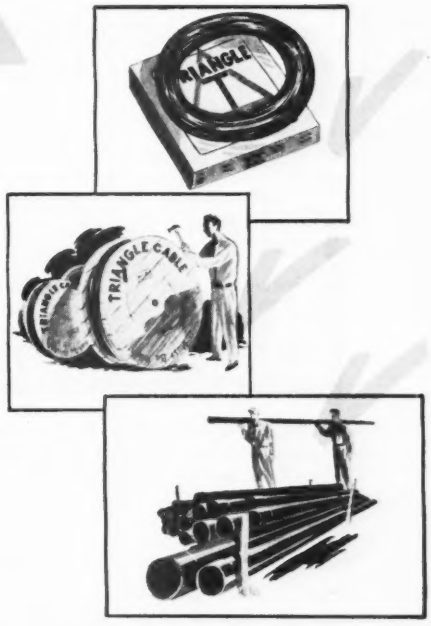
Representatives in all principal cities

When it Comes To WIRE CABLE CONDUIT

Remember— TRIANGLE Makes All Three!

Whether it's a bungalow or an atomic energy plant, when it comes to the selection of wire, cable or conduit, just say "Triangle" to your distributor. It makes sense to order all three with the same brand name. Deliveries are surer, there's less paper work and there's a feeling of confidence right down the line.

We're proud that thousands of America's top engineers, contractors and purchasing agents regularly put their confidence in us. Perhaps the reason is because of what we *give* — friendship, help, cooperation and top quality products.



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You'll Like Doing Business with **TRIANGLE**

The Trade Mark of TOP Quality

TRIANGLE

TRIANGLE CONDUIT & CABLE CO., INC.

NEW BRUNSWICK, N. J. • MOUNDSVILLE, W. VA.

When it's a question of carrying electrical power, specify **TRIANGLE**

SANGAMO DEMAND REGISTERS

demand registers with service experience

Sangamo Demand Registers are built to give years of consistently accurate readings. Service experience has proved them inherently troublefree. For example:

GENERAL

These demand registers should operate successfully without attention for from 4 to 12 years, depending on local conditions, and the Sangamo Electric Company recommends a minimum of preventive maintenance. Best results will usually be obtained if these

This statement from Sangamo's new Service Manual for Demand Registers is based on field experience with thousands of these registers, both singlephase and polyphase.

HERE ARE THE REASONS for the long service life of Sangamo Demand Registers...

1. The exclusive Sangamo-built slow speed, high torque motor with porous, lubricant-saturated bronze bearings.
2. Hardened steel pivots and porous lubricant-saturated bronze bearings for timing gear reductions.
3. Jewelled bearings in the resetting mechanism.

These design features are Sangamo's extra precautions that our Demand Registers will give you economical and complete satisfaction.

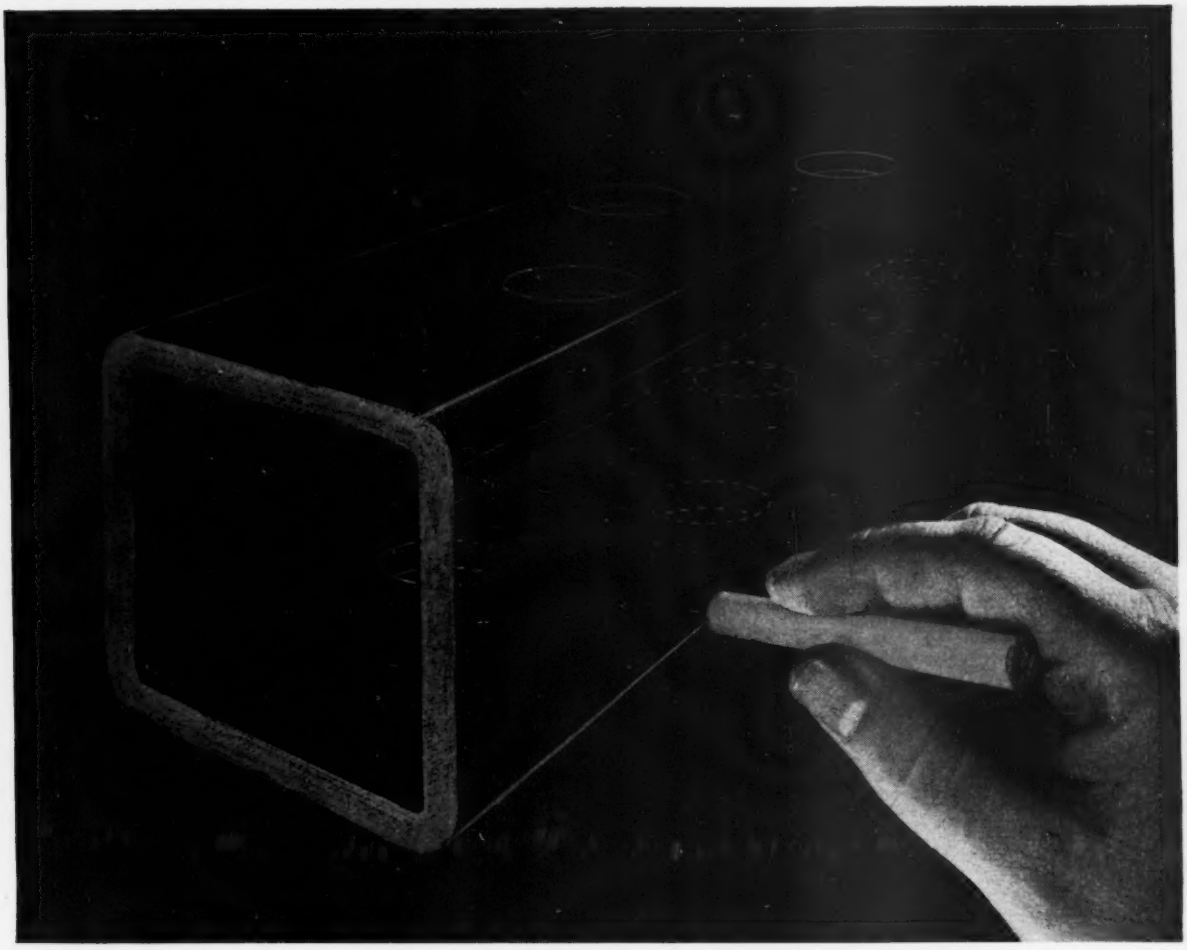
Write for your copies of Descriptive and Service Bulletins 311, 321 and 390.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

SANGAMO

Only Measured Facts are Known Facts

SM53-8



THE ADVANTAGES OF

VENTILATED SQUARE TUBE

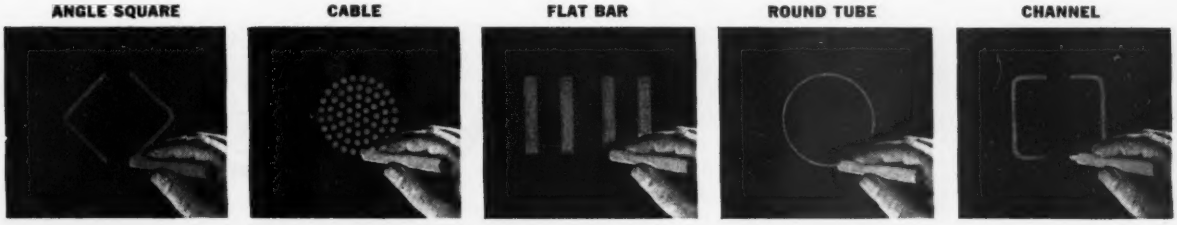
BUS CONDUCTORS

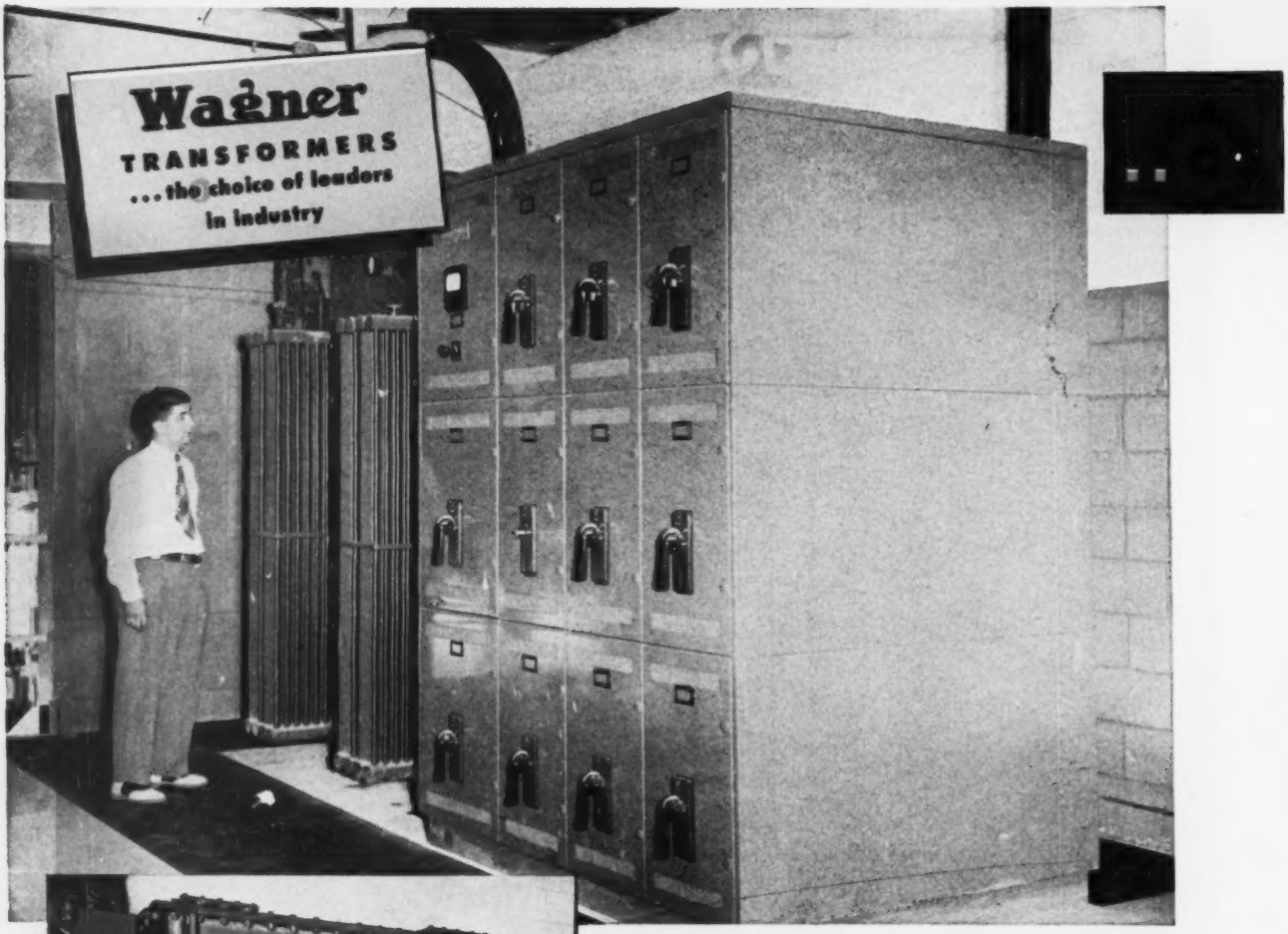
A bus conductor designed as a ventilated square tube has the advantage of high current capacity—approaching that of ventilated angle square or channel square assemblies—combined with greater mechanical strength to permit longer spacing between supports. Its current distribution is more uniform than that of laminated busses.

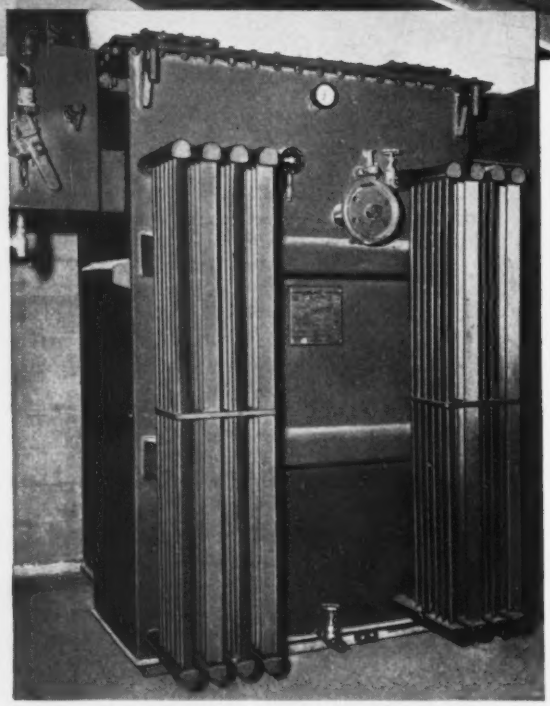
Being a single unit, the square tube, with drilled, staggered, ventilating holes, eliminates the spacers required for angle, channel and other types of multi-bus conductors, while its flat surfaces simplify connections.

There is a complete line of ANACONDA Copper Bus Conductor designs for every type of installation and power requirement. Write today for your copy of "ANACONDA Copper Bus Conductors" containing illustrations and detailed technical information concerning designs and arrangements for bus conductors. *The American Brass Company, Waterbury 20, Connecticut. In Canada: Anaconda American Brass Ltd., New Toronto, Ontario.* 53134

carry the load with ANACONDA® Bus Conductors







1000 kva, liquid-filled unit substation transformer, one of seven, installed at the New Brunswick, New Jersey, plant of the Studebaker Corporation.

The importance of the transformers in your plant power distribution system cannot be overemphasized. If a switch or a circuit breaker fails, only a part of the system is affected—but if the *transformer* fails, the entire system is dead. When you specify Wagner, you can be sure of a dependable, continuous flow of power.

Wagner Unit Substation Transformers, both liquid-filled and dry-type, are carefully designed to meet distribution requirements. Both liquid-filled and dry-type unit substation transformers are built in ratings through 2000 kva, 15 kv and below—you can choose the type and rating that exactly meets your load-center distribution requirements.

Bulletins TU-13 and TU-56 give full information. Your nearby Wagner engineer can help you solve your load-center problems. Call the nearest of our 32 branch offices, or write us.

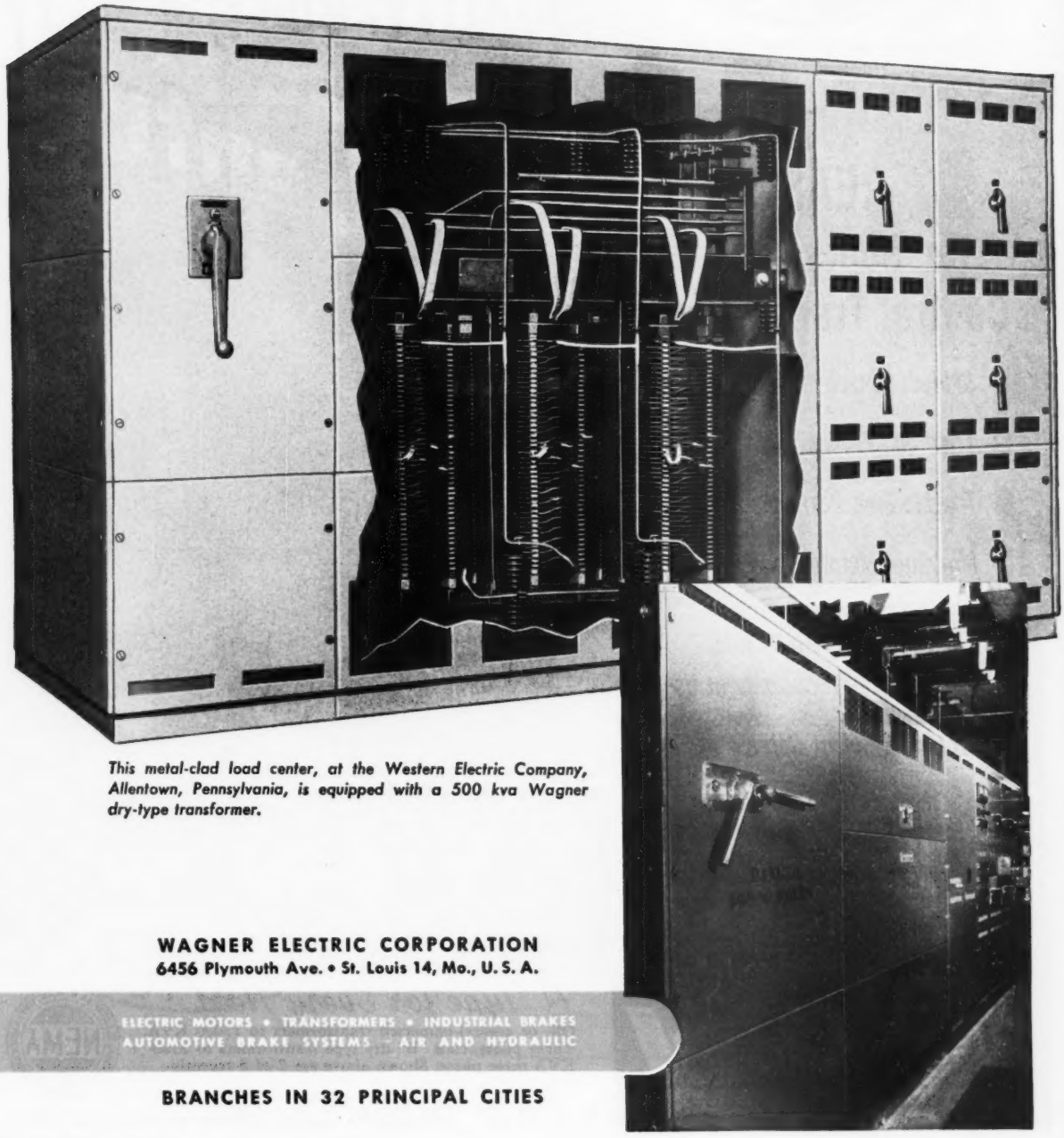
® Wagner Electric Corporation
EST 1891

T53-11

. Don't take transformers for granted

Specify Wagner Unit Substation Transformers

for dependable load-center distribution



This metal-clad load center, at the Western Electric Company, Allentown, Pennsylvania, is equipped with a 500 kva Wagner dry-type transformer.

WAGNER ELECTRIC CORPORATION
6456 Plymouth Ave. • St. Louis 14, Mo., U. S. A.

ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS • AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

★ Phone us regarding your own transformer needs

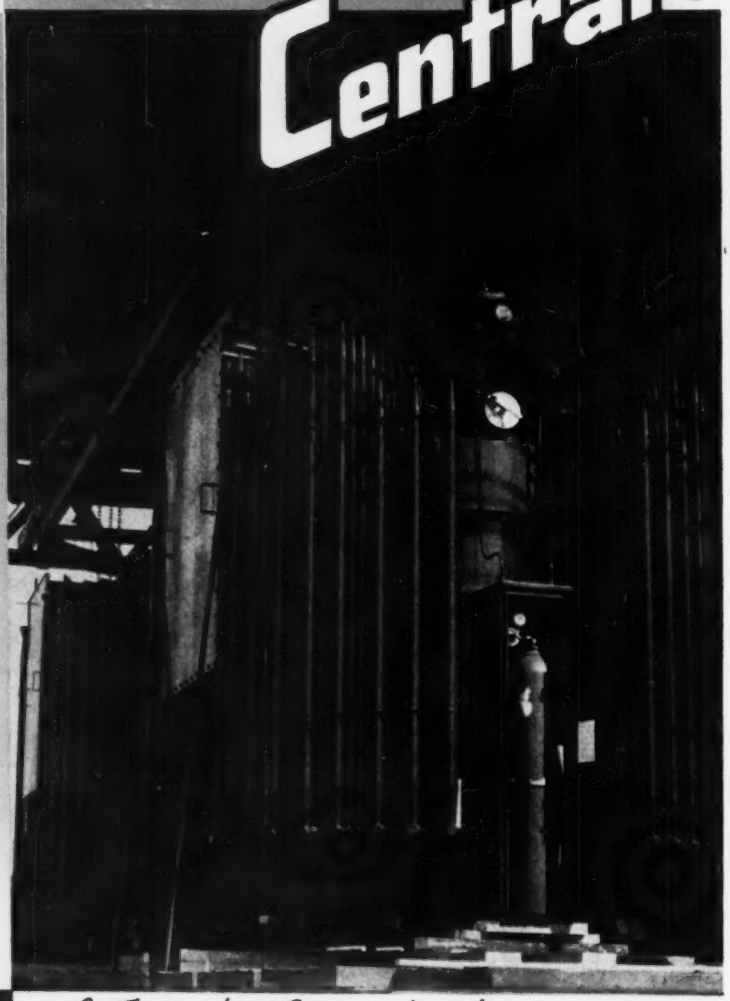
TRANSFORMERS?

We build 'em small, we build 'em big; but every single one is QUALITY-BUILT, at Central!

7 REASONS for Superiority of Central Transformers:

1. *Skilled, Conscientious Workmanship*
2. *Tried-and-Proven Dependability*
3. *Trouble-Free Performance*
4. *Minimum Maintenance*
5. *Long Life*
6. *Reputation—Thousands in use*
7. *Prompt, Efficient Service*

Designed to Eliminate Radio Interference



CTC Central TRANSFORMER CORP.

A Type for Every Need

Oil- or askarel-immersed transformers to 15000 KVA. Three phase, class "B" dry type transformers to 2500 KVA three phase. Shown above are 2 of 8 recently-built 5000 KVA units.

NEMA

PINE BLUFF, ARKANSAS *Sales Offices in Principal Cities*

New Products...new engineering developments... on-the-job reports

IN EVERY ISSUE of the

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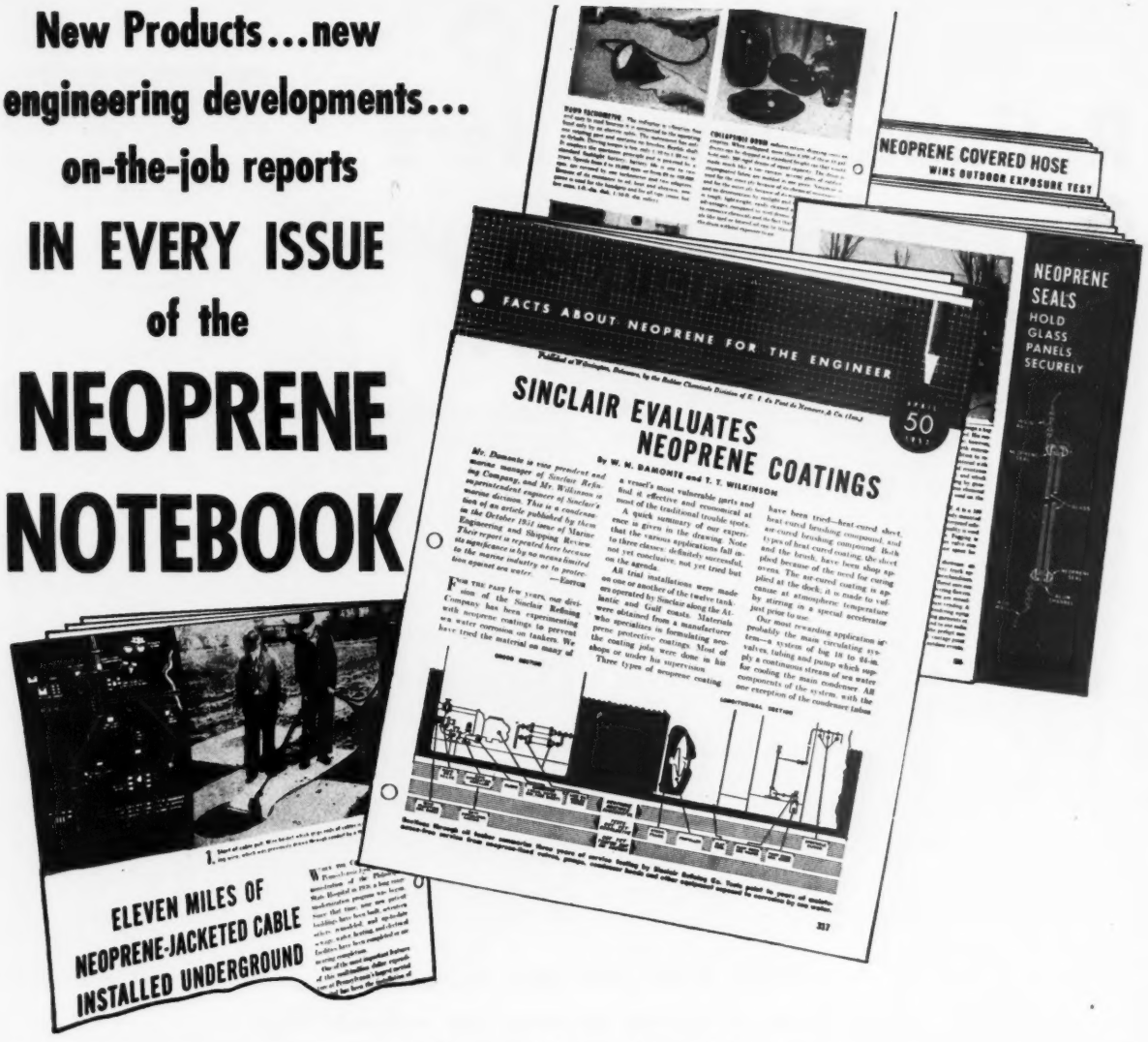
NEOPRENE COVERED HOSE
WINS OUTDOOR EXPOSURE TEST
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HOLD GLASS PANELS SECURELY
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Informative, up-to-the-minute articles report on neoprene's performance in products ranging from oil seals to conveyor belts . . . from motor mounts to work gloves. These engineering facts about neoprene are illustrated by specific data, pictures, and drawings.

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. . . THROUGH CHEMISTRY

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Please examine this great E-M Motor
From bearings to coils to heavy-duty rotor.
Plant auxiliaries run hard and long
So driving motors must be extra-strong.
Read the rhymes and you'll see why
RELIABILITY makes *this* motor your best buy!
No tricky formulas you have to see—
Here we have it in 1-2-3!

Why E-M stresses its ability to design large motors for reliability

1 E-M coils hold moisture out
With high insulation strength all about.
With examination you'll be finding
Repeated varnish coats baked on the winding.
It's earned acceptance and admiration,
This E-M "power house" insulation!

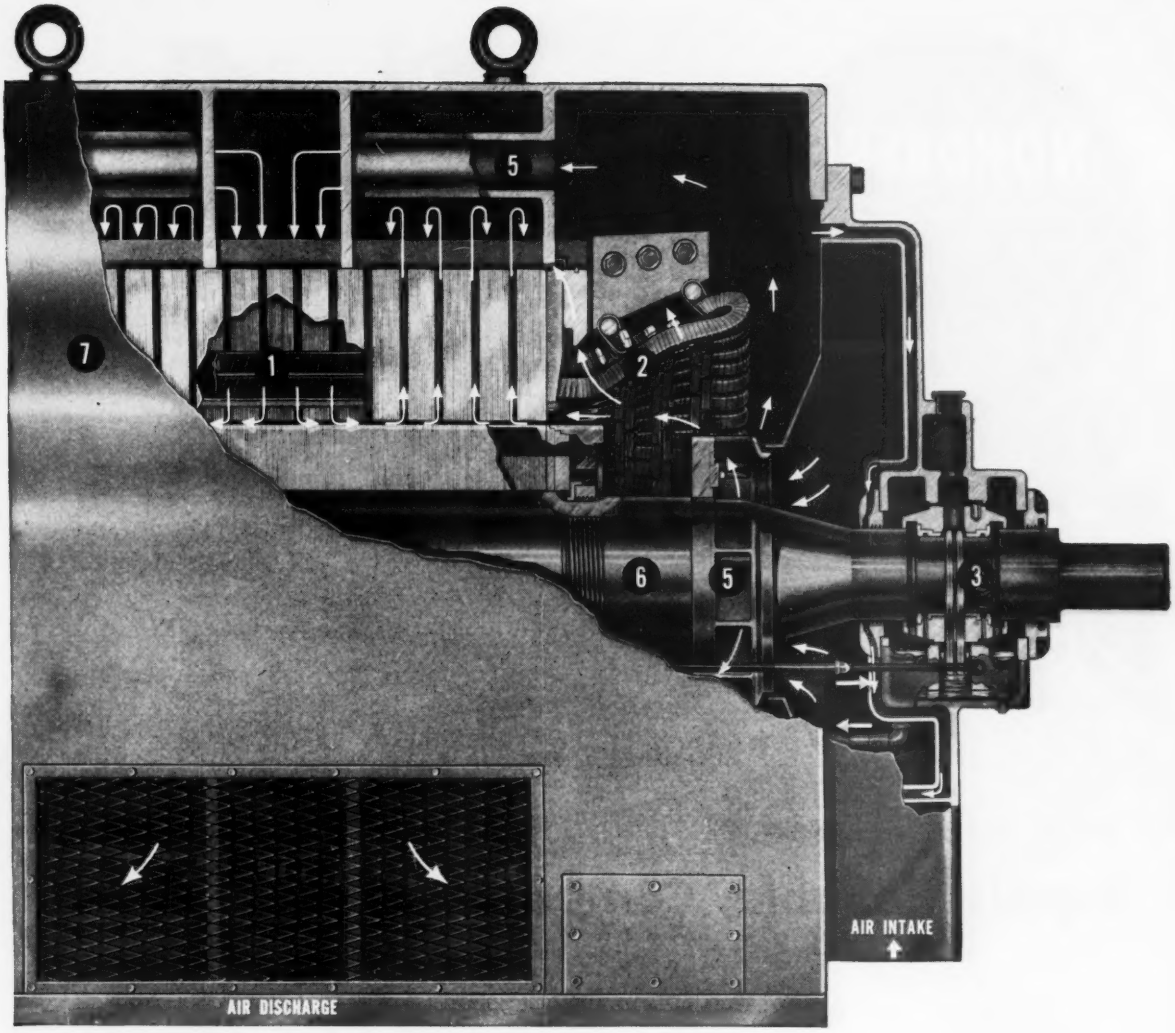
2 You won't find E-M coil-ends in any contortion
Caused by full-voltage starting distortion.
You see, all E-M coils are lashed to each other
And tied to big bracing rings one after another.
You can be sure this E-M coil-end bracing
Is equal to any demand it'll be facing.

3 E-M engineers have had plenty of school
In designing leak-proof bearings that always run cool.
Shaft journals are oscillation-honed so much clearer
Their super finish reflects your face like a mirror.
And the bearing sleeves are centrifugally cast
With strong bond and dense babbitt that last and last.

4 A great deal of your trouble-free operation
Will come from E-M's pressure lubrication.
Take special notice of this choice you are given—
Oil pump can be direct or separately driven.
The oil reservoir gets good ventilation
And it's easy to check the oil circulation.

5 The E-M air distribution is called "Center-flow"
It's uniformly controlled without "big blow".
Aero-dynamically designed blowers have plenty of poise,
Move air efficiently with minimum noise.
You're sure to see, wherever you start,
There's adequate air for each working part.

6 One thing you'll notice about this E-M Motor . . .
Extra-heavy construction of the strong, stiff rotor!
Core laminations have interference fit,
For staying in place, this is really it.
The rotor is balanced with great precision—
A very important smooth-running provision.



E-M 2-Pole Heavy-Duty Squirrel-Cage Induction Motor (1500 HP and larger)

7 One of the most rugged things bearing the E-M name
Is the smoothly-contoured drip-proof frame.
And there's an added noise reduction
In this sleek modern enclosure construction.
It features a "turbine-driven generator" design
When you see it you'll say "This'll be mine!"

These have been some features which you can see—
Large E-M Motors show them tangibly.
Other E-M advantages are behind them, too,
Benefits just as important to you.

For instance, in the field of big motor design
E-M has specialized, straight down the line.
And a broad E-M service organization
Is on "split-second" call across the nation.

When you specify that big motor...now or next year,
Be sure to call an E-M sales engineer.
And before your plant plans get any bolder,
Write for the new big E-M 2-pole Motor folder!

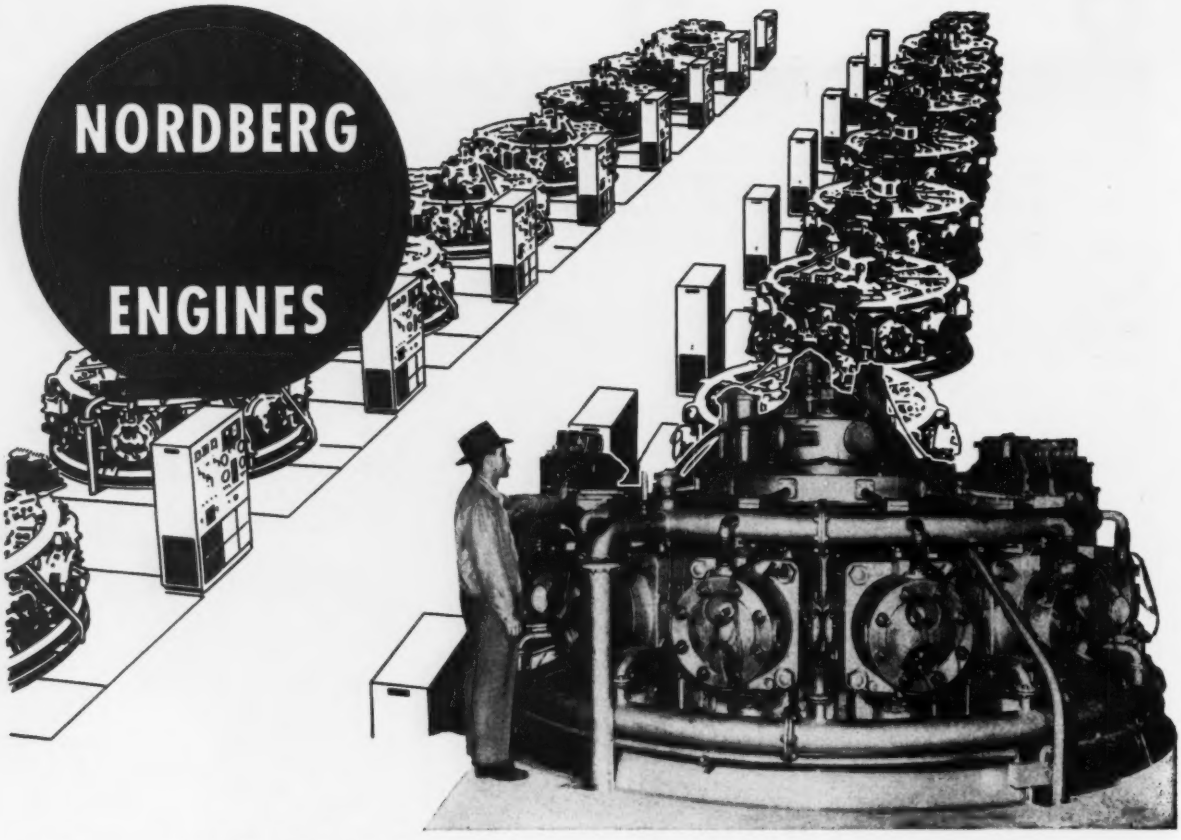
E-M

1300-TPA-2140

ELECTRIC MACHINERY MFG. COMPANY
Minneapolis 13, Minnesota

SPECIALISTS IN MAKING MOTORS DO EXACTLY WHAT YOU WANT THEM TO

NORDBERG ENGINES



Supply Reliable, Compact, Low Cost Power

• NORDBERG 2-CYCLE RADIAL ENGINES develop 1950 to 2125 hp. or 1250 to 1500 kw. at 400 rpm.

Applicable for municipal and industrial power plants and central stations . . . wherever compact, economical, dependable power is required. *For full details, send for Bulletin 200.*

NORDBERG Radial Engines (*Diesel, Duafuel®—Spark-Fired Gas*) offer an unusual combination of design and operating advantages which make them ideally suited for continuous heavy duty power service. *Compare these basic advantages:*

☆ MORE POWER—LESS SPACE ☆ MINIMUM MAINTENANCE

☆ LOW INSTALLATION COST ☆ PROVEN DEPENDABILITY

☆ LOW OPERATING COST ☆ SMOOTH, BALANCED OPERATION

☆ SHIPPED AS A COMPLETE UNIT

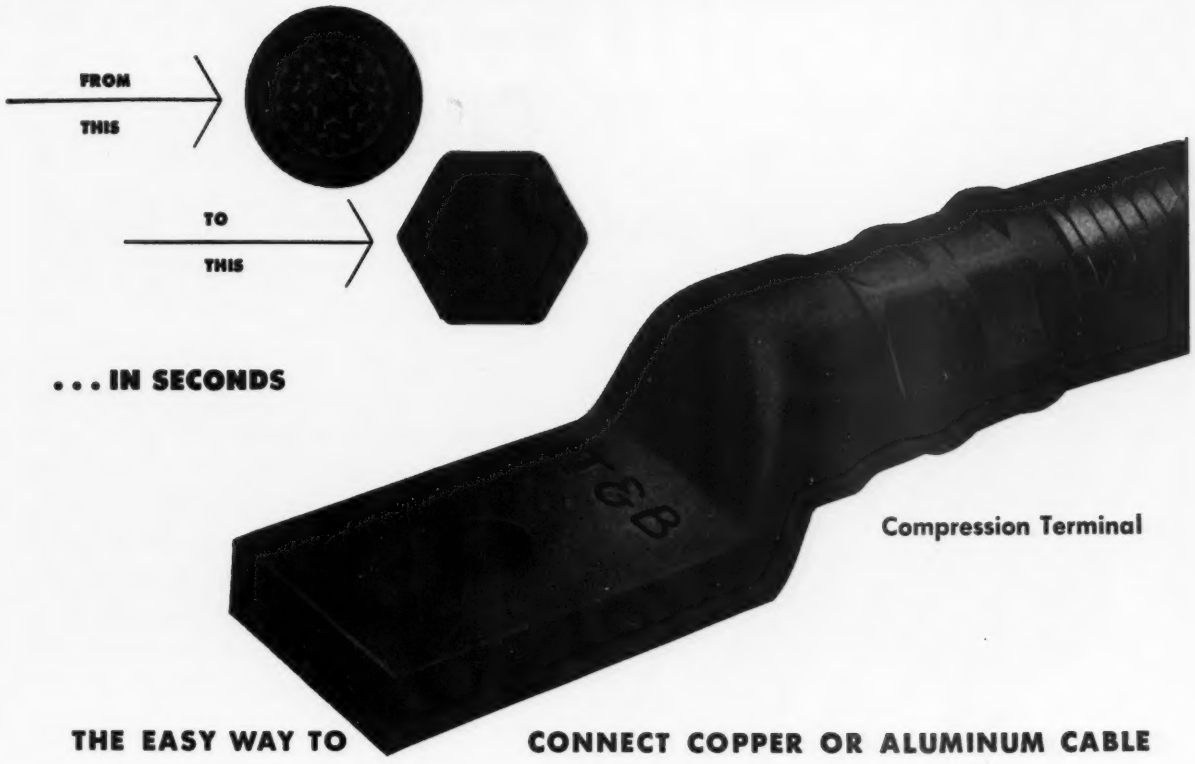
NORDBERG MFG. CO., Milwaukee, Wisconsin

NORDBERG

DIESEL • DUAFUEL® AND SPARK-FIRED GAS ENGINES

P453-R

T & B METHOD



THE EASY WAY TO CONNECT COPPER OR ALUMINUM CABLE

Linemen, electricians and contractors pick the T & B METHOD of making electrical joints for the ease and speed with which tight, electrically-sure connections can be made . . . right on the job. Simply pare off insulation . . . insert cable into fitting barrel . . . and operate hydraulic tool (hand, foot or electrical).

The hardened steel dies of a light-weight, portable T & B hydraulic tool compress around the joint with tremendous hexagonal pressures and force the fitting and cable, into one homogeneous mass . . . all in a few seconds. The all-around pressures exerted over a large area assure maximum contact . . . minimize electrical resistance and voltage drop.

Though the use of an oxide-inhibiting agent is recommended for T & B METHOD *aluminum* connections, no joint compounds are needed to obtain maximum electrical efficiency. For *copper* connections, no special cable treatment is required.

T & B METHOD fittings for aluminum have fine serrations inside the barrel which, during compression, penetrate the insulating film of aluminum oxide on the outside cable strands. At the same time, the oxide film on the inner cable strands is effectively abraded, thereby maintaining a dense, tight joint of high conductivity.

Investigate the complete line of T & B fittings for aluminum and copper cable — they offer you savings in time and installation costs. Write for your free copy of T & B Bulletin #67.

LOOK FOR THIS SIGN— ENGINEERED **IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR**

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T34

THE THOMAS & BETTS CO.

INCORPORATED

14 Butler Street • Elizabeth 1, New Jersey

Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898

Another reason why

Chase

Antimonial Admiralty Tubes last longer!*

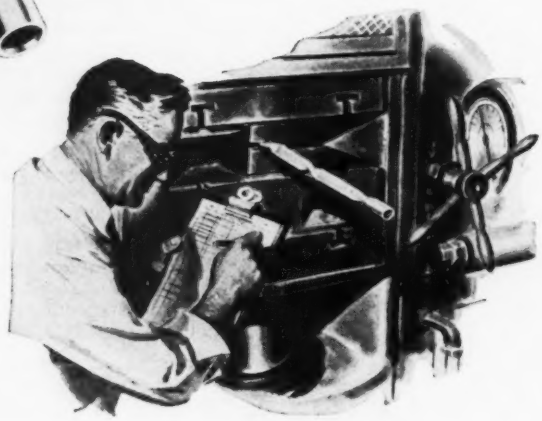
(a patented alloy)

Yes, you can *count* on Chase Antimonial Admiralty Condenser Tubes to give you many years of satisfactory service.

Chase Condenser Tubes are rigidly controlled for quality during manufacture, and various tests are applied when the tube is finished. The flattening test mentioned below is a good example. Wall thickness, diameter, surface finish, concentricity and accuracy of length are carefully determined.

So, for condenser tubes that last and last, *remember:* insist on Chase Antimonial Admiralty!

*U.S. Pat. No. 2,061,921



PUTTING THE SQUEEZE ON IMPERFECTIONS...

This Chase technician is performing a "flattening test" which is an indication of soundness and freedom from hidden defects. You are assured that tubes passing this test will satisfactorily withstand bending or end flaring.

PROMPT SHIPMENTS
from our mills in Cleveland and Waterbury.

Chase® BRASS & COPPER

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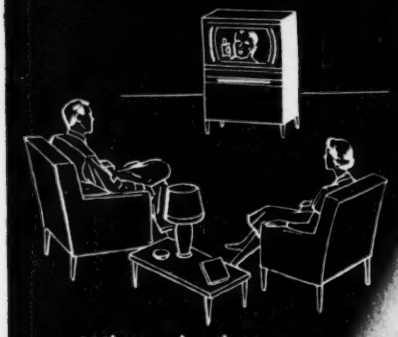
Ne Plus Ultra...



Why take less
than the best?
It costs no more.

Eliminate INTERFERENCE

No Radio and Television Interference Developing at the Insulator!

Only Type "N" Gives You...

1. Fully-matured, vitreous glaze. Impervious to elements.
2. Constant composition—*uniform* conductivity in *all* parts of its mass.
3. Hard, smooth surface. Resists abrasion by conductor.
4. Will not abrade conductor.
5. Uniform composition guarantees constant and uniform characteristics.
6. You will quickly spot its distinctive color.

Ne Plus Ultra—there is none better! *Your customers'* good-*will* is too valuable to jeopardize with radio and television interference developing at the insulator. Porcelain Products Type "N" glazed "radio-freed" insulators are going up on more utility lines every day to satisfy this critical need. They will *prove* themselves on your lines. Write for details.

YOUR INDEPENDENT INSULATOR MANUFACTURER

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Please send me more information about Type "N" Insulators.

Name_____ Position_____

Firm_____

Street_____

City_____ Zone____ State_____

Responsibility...

and a river to cross

Most transmission line spans are routine for Louisiana Power and Light Company. But the broad Mississippi called for a 3850-ft main span, two 1000-ft anchor spans and high water clearance of 150 ft over a busy ship channel.

Alcoa, called in for consultation, designed and manufactured special ACSR to meet the exacting requirements of conductance and tensile strength. Furthermore, conductors were ordered in the accurate lengths required to give specified sags in each span. Cable length determinations for this double circuit crossing involved calculations by experts. Dead-end fittings were applied to each length at the mill before shipment to the job. When pulled up into position, these conductors fitted perfectly.

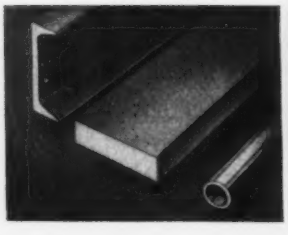
Unusual service? Not for Alcoa. We co-operate readily because we believe that the best installations are just as important as the best products. This is your guarantee of satisfaction with Alcoa Aluminum Electrical Conductors. Aluminum Company of America, 2100-X, Alcoa Building, Pittsburgh 19, Pa.

Alcoa Aluminum

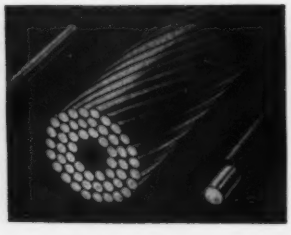
ALUMINUM COMPANY OF AMERICA

"SEE IT NOW" with Edward R. Murrow —CBS-TV every Sunday . . . brings the world to your armchair. Consult your newspaper for local time and channel.

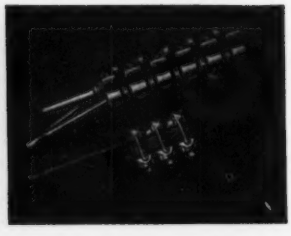
Alcoa Aluminum Bus is available in rectangular and solid round bars, channels and tubular shapes.



Alcoa Aluminum Electrical Conductors include ACSR, solid and stranded aluminum wire, bare or covered.



Alcoa's full line of aluminum accessories, is correctly designed for use with all aluminum conductors.

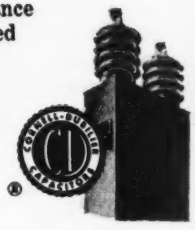


INSTALLED 1942

It has an Unmatched Field Performance Record of Trouble-Free Service!

This C-D 20,160 Kvar capacitor bank installed by a major northwestern power producer in 1942, has an outstanding record for low-maintenance operation. Another typical time-tested C-D installation!

Ask to have a C-D engineer point out the low-maintenance characteristics that are built into every C-D capacitor. Cornell-Dubilier Electric Corp., Dept. D-103, South Plainfield, N. J.



CORNELL DUBILIER

CONSISTENTLY DEPENDABLE

CAPACITORS

PLANTS IN SO. PLAINFIELD, N.J. • NEW BEDFORD, WORCESTER AND CAMBRIDGE, MASS. • PROVIDENCE, R.I. • INDIANAPOLIS, IND. • FUQUAY SPRINGS, N.C. • SUBSIDIARY, RADIART CORP., CLEVELAND, O.

4 Powerful Reasons Why CHEVROLET ADVANCE-DESIGN TRUCKS

work harder . . . work longer . . . work for less!

MORE POWER AT LOWER COST! You can look forward to sizeable savings on gasoline with Chevrolet trucks on the job. In heavy-duty models, the advanced Loadmaster engine with new high-compression ratio of 7.1 to 1 delivers more power than ever—and does it on less fuel! In light- and medium-duty models, Chevrolet's Thriftmaster engine combines top-notch performance, with rock-bottom operating cost.

TAILORED TO YOUR JOB! Of course you want a truck that fits the requirements of your particular job. And you get just that when you buy a Chevrolet truck! You get the *right* power . . . the *right* chassis units from tires to transmission. Chevrolet trucks are *factory-matched* to do your work at lowest cost!

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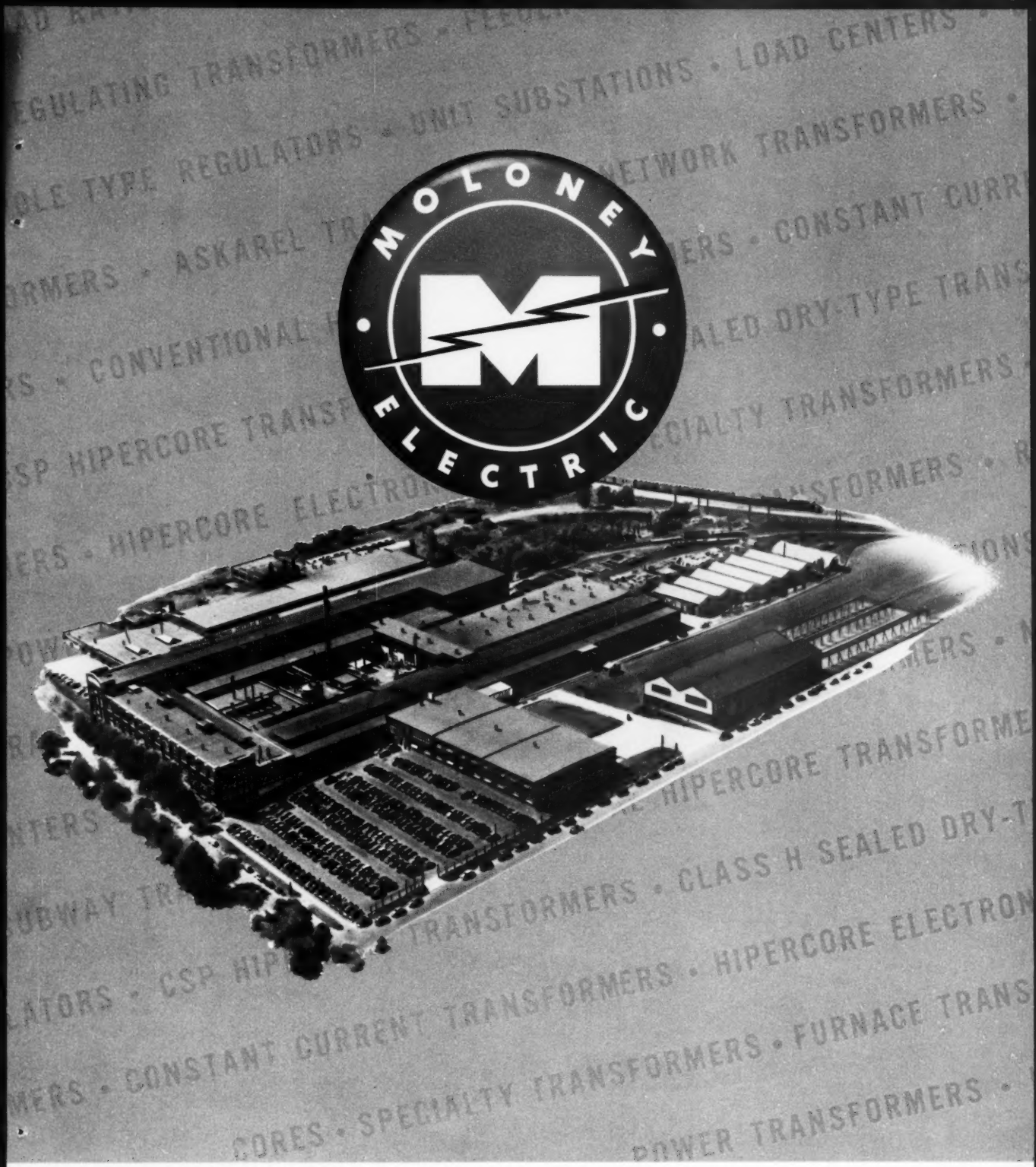
LOWEST PRICED LINE! You start saving money the moment you buy a Chevrolet truck. For, in addition to all its other advantages, Chevrolet is *America's lowest priced truck line!* Why not start saving *now!* Your Chevrolet Dealer will be happy to give you all the facts. . . . Chevrolet Division of General Motors, Detroit 2, Michigan.

CHEVROLET ADVANCE-DESIGN TRUCK FEATURES

TWO GREAT VALVE-IN-HEAD ENGINES—the Loadmaster or the Thriftmaster—to give you greater power per gallon, lower cost per load. **POWER-JET CARBURETOR**—for smooth, quick acceleration response. **DIAPHRAGM SPRING CLUTCH** — for easy-action engagement. **SYNCHRO-MESH TRANSMISSION**—for fast, smooth shifting. **HYPOID REAR AXLE**—for dependability and long life. **TORQUE-ACTION BRAKES**—on light-duty and medium-duty models and on front of heavy-duty models. **TWIN-ACTION REAR BRAKES**—on heavy-duty models. **DUAL-SHOE PARKING BRAKE**—for greater holding ability on heavy-duty models. **CAB SEAT**—with double deck springs for complete riding comfort. **VENTIPANES**—for improved cab ventilation. **WIDE-BASE WHEELS**—for increased tire mileage. **BALL-GEAR STEERING**—for easier handling. **UNIT-DESIGNED BODIES**—for greater load protection. **ADVANCE-DESIGN STYLING**—for increased comfort and modern appearance.

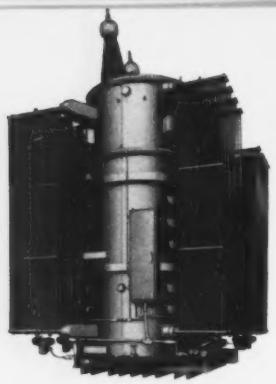
CHEVROLET first in demand in value in sales



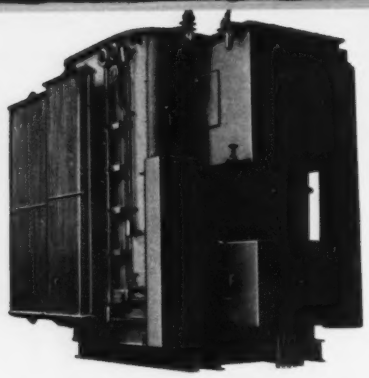
Bulletin No. G-53

MOLONEY ELECTRIC COMPANY

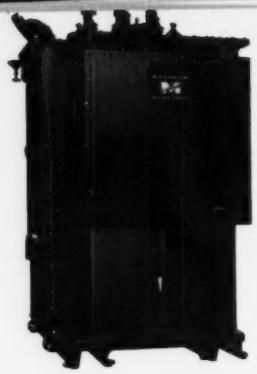
SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA



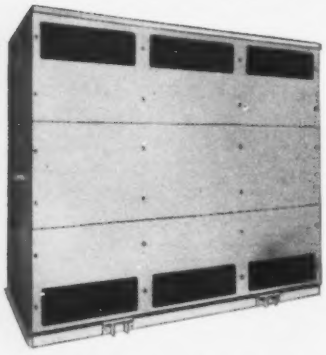
Power Transformers



Load Ratio Control Transformers



Feeder Voltage Regulators and Regulating Transformers



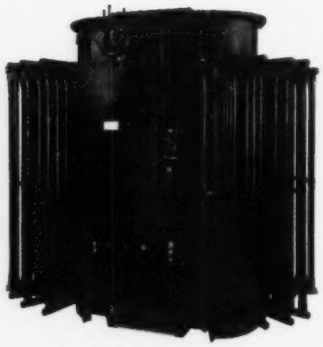
Class B Dry Type Load Center Transformers

MOLONEY PRODUCTS ARE BETTER . . . All along the line

MOLONEY ELECTRIC

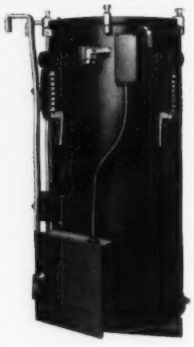
MOLONEY ELECTRIC CO.

Factories at St. Louis 20, Missouri and Toronto. Ontario, Canada



Askarel Transformers

Sealed Class H Dry Type Load Center Transformers

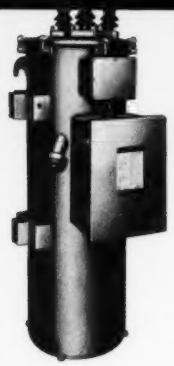


Packaged Unit Type Constant Current Transformers

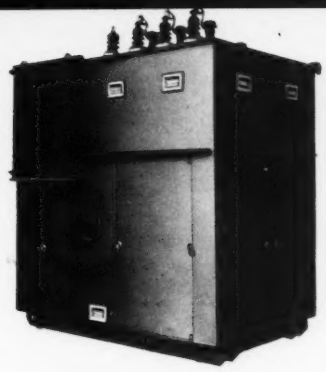
Sealed Class H and Ventilated Class B Dry Type Transformers

Conventional Distribution Transformers

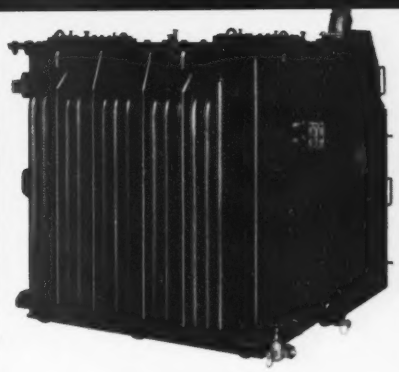
CSP Distribution Transformers



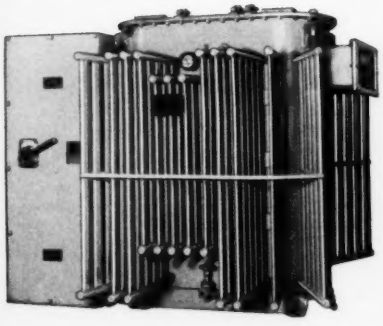
Single-Phase Pole Type Feeder Voltage Regulators



Single Circuit Unit Substation



Network Transformers



Askarel Load Center Transformers

MOLONEY PRODUCTS ARE BETTER . . . All along the line

MOLONEY ELECTRIC

MOLONEY ELECTRIC CO.

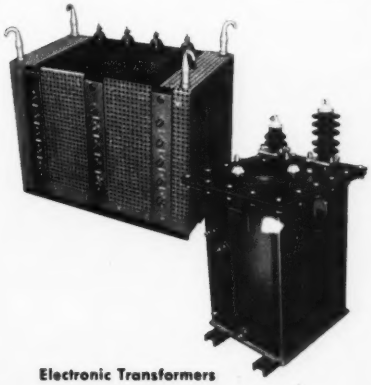
Factories at St. Louis 20, Missouri and Toronto, Ontario, Canada

Subway Transformers

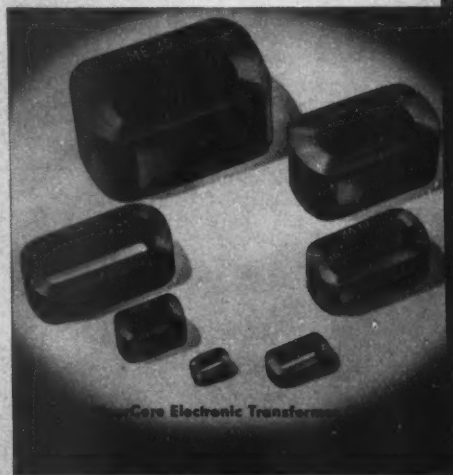
Conventional Type Constant Current Transformers

Furnace Type Transformers

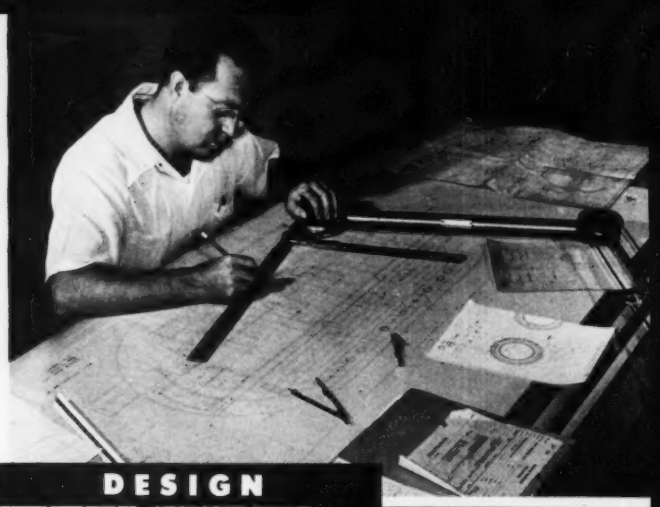
Large Distribution Transformer



Electronic Transformers



Core Electronic Transform



MOLONEY is Better... All Along the LINE

The most important thing that any company builds into its products is the quality which produces its reputation... and all the products shown on the preceding pages bear the Moloney trademark.

For over half a century, the name Moloney has identified equipment designed and built to give better performance . . . and this has been proved by operating records of utilities everywhere. This is what the trademark of Moloney means . . . and all products that carry it must measure up to these high standards.

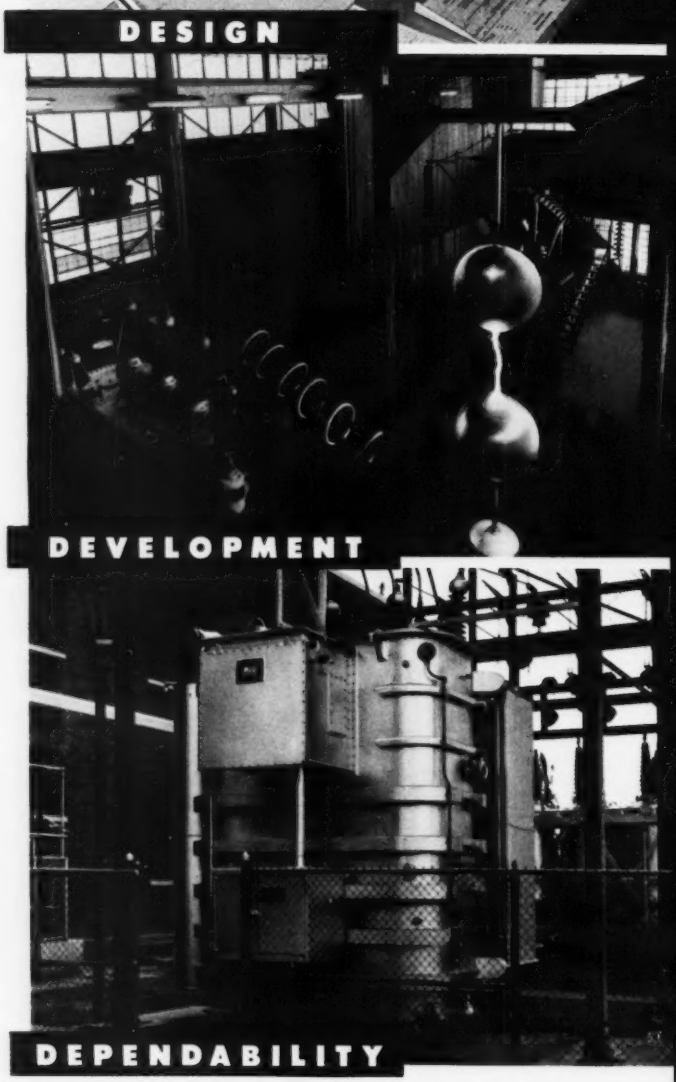
And these are realistic operating standards viewed in the overall dimensions of your power picture. It is a well-rounded approach expressed in Design, Development, Dependability.

Design by leading engineers with years of experience affording them a real grasp of your problems brings you more compact, efficient equipment that performs better, longer.

Development of new ideas, techniques, and materials in Moloney's extensive laboratories makes the latest and best transformers available for your use.

Dependability is engineered and built into every Moloney product by our team of engineers and craftsmen together with better fabrication of materials to make better products. Moloney equipment goes on the line and stays on the line without failure . . . for years, and years, and years.

Specify equipment backed by over 50 years of proven performance . . . make it Moloney *all along the line.*



LITHO IN U. S. A.

MOLONEY ELECTRIC COMPANY

Manufacturers of Power Transformers • Distribution Transformers • Load Ratio Control Transformers • Step Voltage Regulators • Unit Substations

SALES OFFICES IN ALL PRINCIPAL CITIES • FACTORIES AT ST. LOUIS 20, MISSOURI AND TORONTO, ONTARIO, CANADA

"Oh, Well! Nothing to Boast Of"

Now has come the season when power companies should consider how enterprising they are. Each power company should lean back in the office chair, hoist its corporate feet to the desk piled high with problems of finance, engineering, personnel, etc, gaze off into distant space, and give thought to another really important matter.

The results of that thought by some companies will appear next February in the office of the Edison Electric Institute, set out on tables for judges in award competitions to study and stew over.

Other companies will reflect on the matter and decide—or more likely will just drift along without reflection to the conclusion—that they have done nothing that merits recognition in the fields covered by the awards. This is not precisely the most inspiring, uplifting, heart-warming opinion any power company can have about itself. Nor is it one conducive to confidence and enthusiasm on the part of conscientious workers.

So we suggest a train of thought:

The Thomas W. Martin Rural Electrification Award?

"Contribution to rural electrification and agricultural advancement in area served." Did we contribute? Why, that's the reason we have a rural service department.

The Frank Watts Awards?

"Promotional and sales efforts in rural areas." What else has the rural service department been doing?

The George A. Hughes Awards?

"Outstanding achievement in the field of electric appliance sales and promotion—looking to the development of the electric cooking and water heating loads." How many new ranges and water heaters on our lines this year? Deep fat fryers, bun warmers, grills, boilers, ovens in restaurants?

The Laura McCall Awards?

"Acknowledgment to outstanding home service work." Say, those girls have done a swell job. They sure help to keep the customers happy.

The Planned Lighting Awards?

"Most effectively raised the standard of lighting in their communities." There's been a lot of talking about better lighting around here this year. There must have been some doing, too.

The George Westinghouse Awards?

"Outstanding performance in promotion of electric laundry equipment." Where's that report on increases in numbers of automatic washers and electric clothes dryers?

The More Power to America Award?

"Creative, broad-scale industrial electrification." Quite a rise in our industrial energy sales this year. Might be there was some creative work done by the boys.

The Claude L. Matthews Valor Award?

"Extraordinary courage—maintain—restore service." That bad storm last spring. Jim Smith, it was. Yes, sir!

The Reddy Kilowatt Annual Report Award?

"Simplify, dramatize and humanize annual reports." Lord, how we argued about that report. Pretty good, it turned out to be, a lot of compliments on it.

If each power company follows this train of thought, the corporate feet will come down off the desk with a bang, and preparation of award entries will begin pronto.

That Cultural Lag

Over-production, strikes, shortages, and high obsolescence are some of the manifestations that mark industrial progress at various times and places. Often the causes are traced to the engineers' unremitting contributions to modern technology. Society, it is argued, cannot absorb them and readjust itself fast enough. Some propose a moratorium on productive ideas until the "cultural lag" is erased.

In some minds that moratorium would entail a few years of vacation for a million creative American engineers. Actually nothing of the sort would happen. There would be no vacation. The really creative engineers would transfer their talents and energy to other fields—the cultural ones if you please—and show those other fields of endeavor how they can move effectively to catch up with the pace of engineering.

There's nothing of the braggadocio about that assertion. It is happening every day. Medicine has made startling strides when it has adopted the techniques of analysis, exploration, experimentation, implementation, and application habitually used by the engineer. Many of the precepts of human relations as applied in the employer-employee sector have been formulated and executed by engineers.

Engineering is not, as some assert, a mere practicalization of modern science. Engineers performed prodigious feats in Biblical times and through the succeeding centuries. There were engineers before there were physicists and chemists in the modern sense of science. They have a long heritage of evolving method. Their works prove it. That is why more of them should engage in so-called non-engineering activities. They owe it to society to spruce up the lagging arts of politics, industrial management, and social welfare. Engineers could erase much of the "cultural lag" merely by dropping back to the rear of the procession and pushing—intelligently.

Welding Must Pay Its Way

Almost any kind of electrical load will be rated desirable if it can earn a rate that covers whatever special facilities are needed to serve it and also serve other customers adequately. Welding load has often had difficulty winning a desirability rating largely because the customer was reluctant to accept the utility's explanation of the necessity for charging for supplementary supply facilities. The techniques of elucidation have been greatly improved as evidenced by the detailed recital of its approach-philosophy at a recent AIEE meeting by a large utility.

There it was shown that an intermittent and "bumpy" welding load could be taken in routine manner if its fluctuating characteristics were largely lost in the well-behaved and orthodox characteristics of the rest of the customer's motor, light, and heat load. But if the relatively low load factor, low power factor, and low "constancy" factor of the welding load necessitates reinforcement of the supply facilities, a supplementary charge is proper. Thus the added charge might be (per kw) no more than it was (per kw) before the welding load was added. However, the average welding load is not that favorable in characteristics or relative magnitude. Consequently, the added charges to cover the welding supply may be (1) twice the former (non-welding) demand rate if merely a second transformer suffices, (2) some three times if a duplicate feeder is necessary, (3) ten or fifteen times if a separate higher voltage line is required. Various alternatives and combinations would fall in intermediate brackets.

Welding is such a godsend for fabricating plants that higher demand charges like this are not at all prohibitive from the cost angle. The point is that the utilities are ready to offer the best rate and best system reinforcement that will protect other customers and still give the welding machine user a chance to derive the benefits that the welding process bestows.

Push Button Power Plants

Completely automatic generating stations may come some day. In fact they have long been used in small hydro developments. Meanwhile large substations and switching stations have equally long been managed remotely under supervisory control.

If the self-policing steam plant does come it will be because of two primary factors. One is that controls and interlock have been developed to contend with every contingency. At the moment there are a few gaps that need attention. When these have been provided and confidence established in the entire array of controls, then the utility managements may be found willing to listen to proposals for making the next station completely automatic.

But the second factor pops in during the ensuing deliberations. What will happen to the plant's availability and outage record? Will the instrumentation and control be so comprehensive and foolproof that the elimination of man failures will contribute to the bettering of plant availability? That is possible, but more likely is the chance that outage-hours will rise even if the outage frequency is decreasible. That in turn follows because the automatic plant will just shut itself down if something serious goes amiss. Before an emergency crew can get on the scene and into action, they'll first have to figure out what went wrong. More time will surely have elapsed than if an operating staff had been there throughout.

Until critical managements can stack the operating savings against the loss-of-use costs and come out with a reassuring balance in favor of automatic operation, the present plant forces can feel secure in their jobs.

You Better Sell Mom on Adequate Wiring

We all remember the story of the straw that broke the camel's back. That story is being reenacted every day in an unknown number of American homes. Pop bought a wonderful home back in the thirties or the twenties or the forties. Then Mom took over. She started to buy electrical appliances. The wiring stayed the same, but Mom, God bless her, just kept plugging in more appliances. Finally one day the fuse blew. Replacing it was easy. But it kept blowing. That last appliance had broken the camel's back.

You can't blame Mom. She wants modern electrical living. But someone is to blame for not telling her about adequate wiring. If she had been told, you can safely bet that the wiring would be adequate to keep all her appliances operating.

THE ELECTRICAL WEEK

The Issue's News Highlights—Importance of employee attitude in prevention of accidents was stressed by H. J. Crissick in talk before EEI's T&D committee.

Tennessee's Gov Frank G. Clement put case for TVA before Eisenhower but President gave indications he is not completely sold on all of agency's operations.

Coordination of substation and transmission line insulation, system reactive supply, and voltage control were chief topics discussed at meetings of several PEA committees.

Construction resumed at Electric Energy's Joppa (Ill.) plant as a result of federal court order restraining a wildcat strike of 33 ironworkers which had held up work there for a month. The order followed a complaint to NLRB by Bechtel Corp, the contractor, that the ironworkers were engaged in "illegal picketing." Response to the return-to-work order was spotty. NLRB sought a temporary injunction to replace the restraining order until it could decide on Bechtel's charges.

The Administration's new power policy is a "deliberate, shameful, dishonest attempt to raise power costs to the rural electrics and other preference customers," Sen James E. Murray (D-Mont.) charged at a Region 9 meeting of NRECA in Billings, Mont. REA Administrator Ancher Nelsen listened to the attack, then replied that criticism of his handling of the agency was "politically motivated." "Propaganda campaigns employing the big lie technique", he said, were aimed at planting "distrust of me."

First section of Public Service of Indiana's 230-kv H-frame line has been energized between its Wabash River Station and Highland Park Substation in Kokomo.

TVA's Cherokee Dam near Jefferson, Tenn., has placed Unit No. 4 in commercial operation. Unit, rated at 30,000 kw, brings Authority's capacity to 3,321,435 kw.

Future floods at Grand Coulee Dam will be prevented by new concrete and steel bulkheads, adit drains and steel safety doors in the dam and pumping plant galleries. Preventive steps were motivated by a flood in March 1952, when a giant outlet valve was opened inadvertently, endangering the generators.

Boston Edison has opened a new load-dispatching center on Cambridge St., transferring job from its harborside plant, where it had been handled for 39 years.

Halifax Electric Cooperative, Inc, of Brattleboro, Vt., has agreed to sell its distribution lines in Leyden County, Mass., to Western Massachusetts Electric Co for $11,000. Halifax is the only co-op in the Western Mass market area.

Dr. Paul Raver, appointed under the Democrats to head Bonneville Power Administration, will stay on under the Republicans despite rumors to the contrary, Interior Secretary McKay declared in Washington.

Off The Washington Wire—Interior Secretary Douglas McKay has approved 20-year contract between Bonneville Power Administration and three Northwest electric companies. Contracts were signed late last month by the companies and BPA (EW, Sept. 28, p6.).

The major reorganization in Agriculture Department brought no further changes at REA—Secretary Benson said no big shifts are in the offing there.

Adm Ben Morcell, Jones & Laughlin board chairman, will head the new Hoover commission task force on water and power resources. Task: To determine federal government's role in resource development, organization to carry out this role.

Pres George M. Gadsby of Utah P&L will be co-chairman of steering committee on energy resource problems for the Mid-Century Conference on Resources for the Future, to be held in Washington Dec. 2-4.

Disenchanted by losses sustained the last several years on its bus operations in Spartenburg, S. C., Duke Power Co offered to sell the transportation system, lock, stock and 30 buses, for $7,000. There is a prospective buyer, but City Council must approve.

Construction of a 66,000-kw addition to Florida Power Corp's Turner Plant at Enterprise will start after the first of the year. Completion target date: November 1955. . . In California, San Diego G&E announced it will spend $13 million for a second 80,000-kw unit at its Encina Plant. First will be on the line in a year, second in the fall of 1956.

EEI Pres Walter Sammis, who heads Ohio Edison, told Institute's Industrial Relations Committee in Chicago the main problem before the industry's management is still government in proprietary business. This, he asserted, "is one of the reasons our national debt is . . . approximately $273 billion."

In Cleveland Elmer Lindseth, president of CEI Co, predicted at a meeting of security analysts that the industry would spend $50 billion in the next ten years in doubling its capacity. He forecast sales volume would rise from $6.5 billion this year to $13 billion in 1963.

Still waiting for Mexican government action on a rate increase for its subsidiaries there, American & Foreign Power predicted in New York the hike would not be enough. It based this on the fact that Mexican Light & Power Co, a Canadian corporation, just received an increase permitting an 8% return in pesos, after income taxes.

Congratulations—Harold H. Scaff, Ebasco vice president, was elected a director of Controllers Institute of America . . . Dr. Adolph Meyer, who retired in 1946 as managing director of Brown Boveri, was honored at a testimonial dinner in New York "for his pioneering work in the field of gas turbines."

Obituary—Samuel R. Bertron, 73, president of Houston Lighting & Power Co since 1930, died in Houston Oct. 9.

Attitude Plays Key Role in Safety . . .

. . . H. J. Crissick tells EEI's Transmission and Distribution Committee at Minneapolis meeting. Management's part in cutting down the number of accidents is stressed by A. U. Stearns

Attitude is the key to safety, H. J. Crissick told Edison Electric Institute's Transmission and Distribution Committee at its recent Minneapolis meeting.

Let personnel set the goals, he said, and they will be stiffer than management. Management can design for safety in its plant, Crissick declared but 90% of the accidents come from human errors. Statistically he showed that 7,000 serious injuries resulted from over 2 million accidents. Thus, he said, there had been 2 million opportunities to prevent accidents. Crissick is supervisor of safety for Cleveland Electric Illuminating Co.

Employees are proud to be part of a safe utility and they search for safer ways, and watch the safety of fellow workers as they do their own, said A. U. Stearns of Wisconsin Public Service Corp. They know that management demands safety on the same basis as efficiency, economy, sales and sound financing, he declared.

Impetus from Management . . . Impetus for this safety attitude comes from top management, said Stearns. He said it started in 1924 when his company's president recognized the waste of five fatal accidents in a 44 per million frequency rate. The first year's effort dropped the rate to 28.42. The rate has averaged well under five since 1930, Stearns noted and said the record could be matched by any company represented at the meeting.

Cost consciousness lacks the spark to engender real employee enthusiasm, asserted H. E. Cody. Cleveland Electric Illuminating's program, backed by a top-level committee and including widespread employee educational activities, has achieved spectacular results, he said.

But, Cody said, the man on the job is the best qualified man to improve the job. And performance measurements, he stated, supply useful data. "We measure our work, compare our performance, and interpret our results," he declared.

Performance comparisons point up fields that need checking by operating managers, said F. C. Brooks, CEI vice president.

But, he noted, they should include comparison with other utilities. When an operation is found to be too costly, the operating manager can usually find a way to reduce costs, he said.

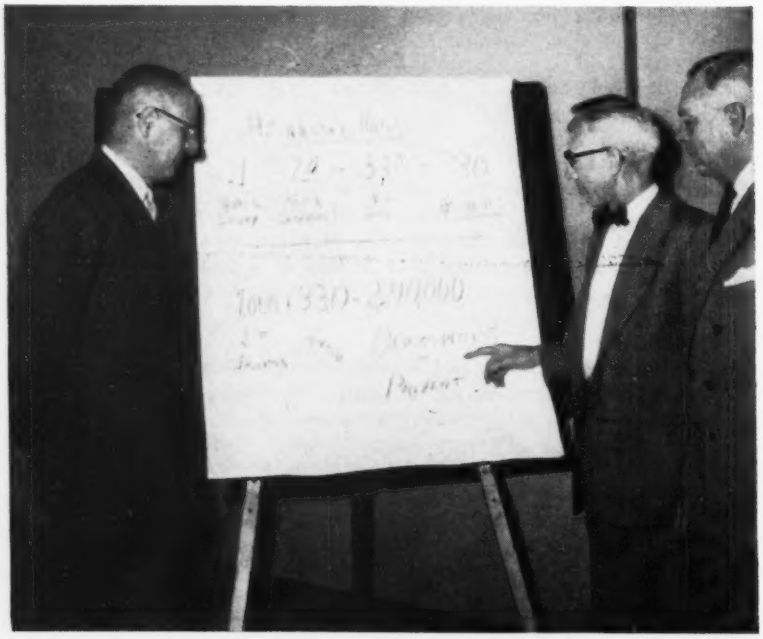
Pole Inspection . . . Acceptance inspection for new poles and crossarms will pay for itself with longer life. This was the opinion of Messrs F. A. Ashbaugh, West Penn Power Co; L. J. Jacobi, Detroit Edison Co; and W. J. Witte, Consolidated Gas Electric Light & Power Co. Extension of pole life three months equals the inspection cost, they said.

Increased safety and assurance that the specifications are met, they added, are other advantages. Eye appeal was not rated highly by two speakers, but Witte said his company considered it very important.

The 4-kv system can supply the highest densities except those areas supplied more economically by the low-voltage network, reported D. K. Blake, General Electric Co. The major benefits from higher primary voltage are reductions in the number of circuits and substations, he said. But regardless of primary voltage, modern overhead systems are adequate for much greater residential loads than are now foreseen, he concluded.

Survey Results . . . Early replies to a questionnaire show conclusively that most companies need fuse cutouts with higher than standard interrupting capabilities, reported E. T. Coupal, Niagara Mohawk Power Corp. Of 12,800 feeders reported 89% have maximum short-circuit availabilities exceeding the standard 50-amp and 79% exceed the 100-amp cutout capability, the sufvey showed.

Television interference is not generally considered a major problem, concluded R. W. Baker, Georgia Power Co, from a questionnaire. Insulators, cutouts, switches, arresters, unbonded hardware, loose ties, and poor joints are the worst offenders, he said. But,



OPPORTUNITIES for preventing accidents, presented statistically on blackboard, are pointed out to safety group sponsor, G. H. Fiedler (left), by H. J. Crissick, supervisor of safety, CEI. Co-speaker with Crissick on safety, A. U. Stearns, Wisconsin Public Service looks on at right

he added, only 18% of reported complaints could be attributed to the electric system.

If it were not for the cost, considerably more lead-covered cable would be installed by utilities, F. C. Marschner, Detroit Edison Co, deduced from a network operations survey. Of 25,332 miles of cable installed as of 1952, 10,139 miles were non-lead. Rubber-neoprene cable has grown to 4,675 miles from 199 miles in 1946, he said.

Cable Failures . . . Cable failures per 100 miles per year, Marschner said, were as follows: Lead-covered cable, 2.1; non-lead cable, 6.67; and rubber-neoprene cable, 0.32.

The 1951 cable operation report shows 8 cases of trouble per 100 miles of cable, said H. L. Davis, Jr, Philadelphia Electric Co. Of these 6.9 were complete failures and 1.1 removals. Failure rate was highest in 20 years, mostly on 25 to 45 kv cable and over 40% from mechanical damage. Preliminary 1952 data show a slight improvement, down to 7.5 failures per 100 miles.

Trouble rate for 1/c, 15 to 25-kv cable joints was the highest since 1936, because utilities are removing unsatisfactory joints prior to failure, Davis said. Thirty-five per cent of these troubles are accountable to poor material and workmanship.

Secondary capacitors in transformer vaults reduced network loading 9% the first year, said G. T. Hays, Dallas Power & Light Co. Up to 2.92 kvar per kva reduction in load costs less than additional network capacity, he said. Other advantages, reported Hays, are improved operating conditions in duct lines, transformer vaults, and some auxiliary equipment at the generating station.

Air Conditioning Load . . . Efforts to achieve better power factor for air conditioners have made little progress, said Bryce Brady, Oklahoma Gas & Electric Co. During the summer, he noted, his own company lost 70 transformers from air conditioning loads. And many motors stalled from low voltage after blowing mid-point fuses of banked secondaries, he said.

Inadequate appreciation for power factor among motor appliance people was cited by D. K. Blake, General Electric Co, as a contributing cause. He urged talking "vars" in an industry educational program.

GOVERNOR CLEMENT of Tennessee, Mrs Clement, and their son Robert visit with President Eisenhower after the Governor and Chief Executive held an hour-long discussion on TVA

Eisenhower Still Wary on TVA

Governor Clement of Tennessee only does partial selling job in one-hour conference with the President

Tennessee Valley Authority is having a tough time making the grade with the Eisenhower Administration.

At a recent news conference, President Eisenhower said there are certain features of the TVA development that are alarming to his political philosophy. While this seemed somewhat milder than his earlier characterization of the agency as an example of "creeping socialism," it was clear that the President is not completely sold on the agency's operations.

The statement came on the heels of an hour-long conference between the President and Tennessee Gov Frank G. Clement, a leading backer of TVA development.

Eisenhower said the Governor had presented some facts of which he was not previously aware, but Clement had failed to win him over completely to the pro-TVA viewpoint. Clement invited Eisenhower to appoint a fact-finding commission to take a look at TVA, and the President said the request is being considered.

Clement's Report . . . Clement also presented Eisenhower with a written five-thousand word argument on the merits of TVA, making these claims:

- Users of TVA power pay their own way.
- TVA is a bulwark of national defense.
- TVA's "yardstick" power rates have served as an example or inducement to private power companies the country over. As a result, the national average electric rate has been cut 60%.
- TVA performs no services that have not been performed by various other government agencies for many years.
- The TVA development, with its emphasis on cooperation with state and local agencies, has become almost a way of life to the six million people in the seven-state TVA region.

Clements visit to the White House appeared to be part of a broad campaign on the part of TVA power users to obtain federal backing for continued expansion of the agency's power facilities. Earlier this month, TVA Board Chairman Gordon Clapp had accused electric companies of trying to undermine TVA (EW, Oct. 12, p 8).

Raising Fund . . . TVA power user groups are reportedly attempting to raise $100,000 to fight their battles in Washington.

Immediately at issue is construction of a new 450,000-kw steam generating plant to be added to the TVA system north of Memphis, Tenn. The agency this year asked for $30 million to begin this construction, but the request was turned down.

Test Case . . . TVA backers have now put this project up as a test case on the future of TVA. From their point of view, the refusal to provide money for this plant would mean the administration is out to halt the expansion of TVA power facilities upon completion of projects already under way.

Denial of funds for the project this year was ostensibly for reasons of economy, but during hearings before Congress several lawmakers made it clear they oppose the Fulton plant for policy reasons. Their view is that TVA power was originally an adjunct to river development and that steam plants were authorized merely to firm up the hydroelectric generation. Now with the TVA system swinging toward a preponderance of steam generation, they feel the agency is going beyond original Congressional intent.

Sole Supplier . . . Present TVA contracts with its power utility customers prohibit these customers from acquiring power from other sources. This puts the agency in the role of sole supplier of power for most of the area it covers. A bill introduced in the waning days of the past session of Congress would abrogate the sole supplier clauses in present contracts—permitting customers to generate their own power or purchase outside power.

Utility-Co-op Meeting

Representatives of ten electric companies and six generating and transmission cooperatives in the Missouri-Oklahoma area met at Springfield, Mo., early this month in an effort to chart a possible course for coordinating facilities. The co-ops had previously planned to tie in with an SPA transmission system, but funds for this arrangement were cut by Congress. At the preliminary meeting a working committee was set up to study means of alleviating the co-op problems.

NEW OPERATING CENTER to be occupied this month by Metropolitan Edison Co is being shown, in model form, by Chief Engineer Ralph Neidig to officers of Pennsylvania Electric Association's engineering committees. Committee officers are (l to r) C. H. Schofer, Pennsylvania P&L chairman, T&D committee; C. M. Skooglund, West Penn Power, chairman, Electrical Equipment Committee; and E. L. Schlottere, Philadelphia Electric, vice chairman, engineering section

Insulation Coordination . . .

. . . is discussed at joint meeting of PEA's Transmission and Distribution and Electric Equipment committees

Coordination of substation and transmission line insulation was the featured subject of a symposium at the joint fall meeting of Pennsylvania Electric Association's Transmission and Distribution and Electric Equipment Committees at Reading, Pa., Oct. 8-9.

General Electric Co's I. B. Johnson and J. W. Yetter concluded that use of rod gaps as primary protection is untenable today, even on the line side of breakers, in substations that have reduced insulation withstand levels. More detailed evaluation is needed of surge distribution in stations because of lightning and switching, they said. Because of past emphasis on lightning surges, the GE engineers pointed out, analysis must be made of switching surge voltages as BIL and 60-cycle insulation withstand values are reduced from fully insulated values.

System Problem . . . I. W. Gross, American Gas & Electric Co, noted that insulation coordination is a system problem and not one of individual apparatus. Today, he said, the work of rationalizing system insulation coordination, started 25 years ago, has reached a stage where those active in the work can feel that it is on a sound and logical basis. On only two things is new information needed, Gross said. These are characteristics of lightning arresters and experience in the field.

John M. Sheadel, Ohio Brass Co, acknowledged that when higher transmission line voltages are considered, engineers become increasingly concerned about the electric stress on the insulators. It might be thought he said, that as voltage is increased to 400 kv, line-to-ground, the line insulator of the 18 unit string will be required to support 20% of the impressed voltage or about 80 kv. This does not occur, he said, because overstress at the line end of the string causes localized breakdown. Resulting corona increases capacitance of the line and insulators, self corrective action occurs, and voltage distribution is automatically modified, Sheadel stated. Tests far beyond present applications at 330 kv indicate no upper limit to the use of standard suspension insulators and

conventional suspension clamps with proper control rings, he said.

Use of Synchronoscope . . . J. M. Clayton, Westinghouse Electric Corp, said the use of the synchronoscope, a miniature surge generator with synchronized receiver used in studying lightning problems by direct measurement on actual systems and apparatus, is leading to more accurate analog computer methods for solving lightning and insulation coordination problems.

In comparing power circuit breaker bushing spacing used today, with NEMA switch and bus spacings and with proposed AIEE minimum phase spacing, E. A. Williams, I-T-E Circuit Breaker Co, pointed to the wide discrepancies that exist. He called for standardization efforts that would bring these values into closer agreement. But he saw no reason for the use of greater phase spacings than the minimums proposed by AIEE, particularly where cost savings were possible through their use.

Howard A. Frey, Locke Department, General Electric, discussed the effect on insulator characteristics of variations in methods of mounting atmospheric conditions, surface conditions, wave form, and variables of unknown origin.

Solving TVI Problems . . . TVI problems have been solved, stated F. L. Green, Ohio Power Co, by using improved hardware, radio-proof insulators, double coil spring lockwashers, spool type insulated neutral supports and quality lightning arresters on distribution circuits, and by using static-proof hardware such as washerhead bolts and nuts, and ground clips, and post type insulators on transmission circuits.

Three-phase automatic reclosers can be supplied with 100,000 kva interrupting current, according to Richard C. Kirk, Line Material Co. Units for 12 and 14 kv can have provision for tripping on ground faults, remote shunt tripping, shunt lockout, and can include ammeter jacks, he said.

W. B. Morton, Pennsylvania Power & Light Co, exhibited by model and pictures construction of the Hosensack substation. At this substation string bus type construction was used for both 220 and 66 kv circuits. Hook switches were more economical than group operated disconnect switches, he said.

System Reactive Supply . . .

. . . voltage control discussed at meeting of PEA's new System Planning Committee held at Bedford Springs

Vigorous and occasionally divergent views were voiced on the topic of system reactive supply and voltage control at the first meeting of Pennsylvania Electric Association's new System Planning Committee at Bedford Springs, Pa., Oct. 4-5.

The split in viewpoint occurred over the relative responsibility of generators and capacitors for kilovar supply on concentrated urban-type utility systems and on more scattered systems where distance transmission is a factor.

Differing needs of these two types of systems were analyzed by H. A. Woodrow and H. O. Simmons, General Electric Co. They noted that where high-density secondary networks are fed from a station generator bus, the station can take care of voltage control and load kilovars can be supplied logically by the station. But where distance transmission is a factor, the station may generate some of the transmission kilovar losses. Transmission economy demands high line loading and kilovar generation on the receiving system to hold up transmission voltage and supply load-area kilovars, they said.

Supplying Kilovar Needs . . . Whether system kilovar needs are best supplied by synchronous condensers or shunt capacitors operating at transmission or distribution voltages, was discussed by F. N. McClure, Westinghouse Electric Corp. He observed that high-voltage banks switched in a single step may offer lower first cost than switched distribution capacitors. Installation and maintenance costs can make the economies of high voltage banks even more favorable, he said. However, he noted, capacitors must be located when kilovars are needed to supply kilovar losses of heavily loaded transmission circuit.

While acknowledging advantages of lower losses and gains in capacity possible with capacitors, V. E. Hill said loss savings are relatively small on Duquesne Light Co's fairly tight and compact system. Reactive supply and voltage control come from generators

Changes in Capacity Reported to FPC

PLANT ADDITIONS DURING AUGUST

State	Utility	Plant	Fuel	Capacity
Pa.	Philadelphia Electric	Delaware	S	125,000
Ohio	Cleveland, Department of Light & Power	Lake Road	S	25,000
Ind.	Public Service of Indiana	Wabash River	S	90,000
Mich.	Wisconsin Michigan Power	Hemlock Falls	H	2,800
Mich.	Detroit Edison	St. Clair	S	125,000
Wis.	Cedarburg Light & Water Commission	Cedarburg	IC	2,000
Mo.	Union Electric of Missouri	Osage	H	21,500
Kan.	Hugoton Water & Light Department	Hugoton	IC	1,136
Kan.	Washington Municipal Light Plant	Washington	IC	675
Okla.	Perry Light & Water Plant	Perry	IC	1,000
Tex.	Southwestern Public Service	Plant X	S	80,000
Idaho	Washington Water Power	Cabinet Gorge	H	50,000
Colo.	Colorado Springs Department of Public Utilities	George E. Birdsall	S	15,000

PLANT RETIREMENTS DURING AUGUST

Okla.	Public Service of Oklahoma	Sand Spring	S	2,500
Tex.	Gulf States Utilities	Lakeside	S	8,000
Tex.	Gulf States Utilities	Orange	S	9,000
Calif.	Pacific Gas & Electric	Covelo	IC	75
Calif.	Pacific Gas & Electric	Laytonville	IC	140
Calif.	Pacific Gas & Electric	Sierra City	H	30

H—Hydro, IC—Internal Combustion, S—Steam
United States Capacity as of Sept. 1—Hydro, 21,300,505 kw; Internal Combustion, 2,130,631 kw; Steam, 63,214,651 kw; Total, 86,645,787 kw.

and all distribution load is provided with individual feeder regulators or equivalent, he stated. For further needed voltage improvement to non-distribution customers, he said the trend has been to sub-transmission bus control by step regulators.

Economics of Regulation . . . W. L. Peterson, Allis-Chalmers Manufacturing Co, pointed out that recent introduction of low-cost distribution regulators for load area use have changed the economics of bus and feeder-voltage regulation. Minimum costs suggest bus regulation for loads above 5,000 kva and distributors regulation below 5,000 kva, he said.

Peterson listed as possibilities to be investigated in the search for low cost regulation as: Bus and supplementary load-area regulation, regulation in sub-transmission substations with load area re-regulation, and elimination of substation regulation with load area regulation when required.

Today overall generation costs are holding steady and construction costs of transmission and distribution have more than doubled, F. M. Reed, Pennsylvania Electric Co, pointed out. For this reason, he said, hauling large quantities of kilovars over circuits and the construction of circuits to carry less than their economic load can no longer be justified. Penelec's solution, Reed said, has been to place automatically controlled capacitors as far out as practicable on distribution circuits where they give maximum voltage improvement for minimum capacity, reduce kilovar losses in the system, and extend, amplify, and modify the effect of voltage swing at the generator bus.

Thirty of Philadelphia Electric Co's 31 steam generator units are connected directly to distribution buses which supply a substantial portion of the load distributed, to high tension customers, F. H. Housel declared. Voltage regulation for these customers is obtained by scheduling bus voltage, he said. Practically all primary distribution circuits are equipped with voltage regulators. Housel pointed out out that the ratio of high tension customer to load supplied to low tension distribution substation is 0.8 to 1.0. The bulk power system integrates all generating stations by means of transformers connected to the generator station distribution buses. Operators regulate top changers to keep reactive flow off bulk power system, he said.

Newest Production Tools Displayed

The latest electrical products were displayed and demonstrated by 33 electrical equipment manufacturers at the 1953 Industrial Electric Exposition held Oct. 6-8 at the William Penn Hotel, Pittsburgh, Pa.

In the picture Lu Shank (right) National Electric Products Co, explains a new conduit accessory to Frank Mahon (left) J. W. O'Nan (second from left) and Philip A. Fleger (second from right) all of Duquesne Light Co, and H. H. Johns, Jr, manager of the Electric League of Western Pennsylvania, sponsor of the Exposition.

At the opening luncheon, Fleger, who is chairman of the board of Duquesne Light, said that today's investment in tools per worker is more than 20 times what it was in 1900. He said that since 1900 the output per manhour in industry has increased about 400%.

Niagara Mohawk Asks OK on Interchange Plan

Niagara Mohawk Power Corp is requesting permission from the Federal Power Commission to export electric energy to the Hydro-Electric Power Commission of Ontario, Canada.

The recently filed proposal would permit the New York utility to transmit up to 250 million kwhr of energy annually to the Canadian utility. Transmission would be over existing facilities of the St. Lawrence River Power Co and Cedar Rapids Transmission Co. The latter company is a Canadian corporation with transmission lines which would take the energy from the U. S. border opposite Massena, N. Y., to a point on the commission system near Cornwall, Ontario.

If approved the application will allow interchange arrangements between Niagara Mohawk and the Ontario Commission. The New York utility is presently receiving energy from Canada through the Massena connection and also receives additional amounts of energy from the Ontario Commission at Buffalo and Niagara Falls.

Energy transmitted to Canada under the proposal would be predominantly steam-generated and would be delivered on a "when, as, and if" available basis. Niagara Mohawk said it would export energy only after all commitments to U. S. customers have been met fully.

Other items in the week's news will be found starting on page 222.

SCHEDULED MAINTENANCE brings electronic amplifiers used in instruments for boiler room control and metering to station test room for repair at regular intervals. Commonwealth Edison keeps enough spare parts on hand so that meanwhile operations are not hindered

Growing Electronic Applications Bring

New Plant Maintenance Problems

Commonwealth Edison has 1,500 tubes of various types in Ridgeland Station. Its experience with faulty fabrication and parts, critical circuit designs, and tube failures shows need for careful testing before operation and regular maintenance

H. L. GARTON, Commonwealth Edison Co, Chicago, Ill.

Rapidly increasing use of electronic tubes on the power system has introduced many maintenance problems. Today at Commonwealth Edison's new Ridgeland Station there are more than 1,500 tubes of various types. When completed the station will have over 2,000 for many purposes.

Control Equipment . . . With two units and four boilers installed at Ridgeland Station more than 700 tubes are used to provide automatic steam pressure regulation and to maintain proper fuel-air relationships in the cyclone furnaces.

Electronic load controllers automatically regulate the load on each machine.

Electronic rappers knock ash deposits from precipitators.

Electronic devices control air conditioning units.

Photo-cell control turns aircraft warning lights on stack "on" and "off".

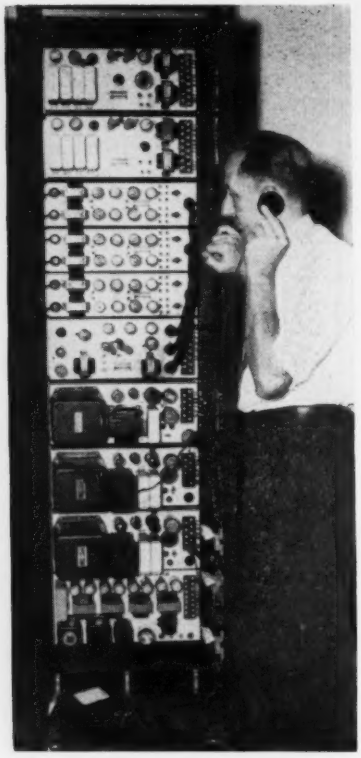
Carrier current actuates relays on circuit breakers on high-voltage lines.

Instrumentation . . . Electronic instrumentation applications in generating stations include:

- Electronically-balanced temperature, smoke density, oxygen, and steam flow recorders.
- Hydrogen purity and vibration recorders.
- TV cameras and receivers which remotely indicate such things as boiler water level and stack emission.
- Telemetering which totalizes entire station load and records that load at the station and at the dispatcher's office.
- Demand meters which print station demand at half hour intervals.
- Electronic printing ammeter which prints remotely or locally on teletype machines the load carried by selected lines or circuits.

Communication Equipment . . . All company generating stations, distrib-

CARRIER CURRENT EQUIPMENT for protective relaying and voice communication on a 147-mile, 220-kv line is checked and repaired if necessary by member of repair crew



TELEMETERING for totalizing station load contributes much to efficient operation

uting stations and the load dispatcher's office are equipped with two-way radio for interstation communication during emergencies.

An intercom system at Ridgeland Station has nearly 150 speakers and almost as many microphones.

A carrier-type intercom system operates between gantry crane at coal pile and coal handling room. Voice-modulated carrier signals are superimposed on power leads to the crane.

Exclusive of Ridgeland Station, additional electronic applications include:

A complete mobile radio system including transmitters, dispatching centers, and over 100 radio-equipped cars and trucks.

An electronic telemetering system which operates between nine generating stations and a load dispatcher's office. In each station the loads of the generators are electronically totalized and metered. These individual station totals are telemetered to the load dispatcher's office where all loads are electronically totalized. This total is then telemetered back to each of the generating stations.

An electronic load controller is being installed to control tie line loads, system frequency, and time.

Electronic fault locators employing the radar principle are used to locate faults on transmission lines, underground power cables, and telephone cables.

A radar set is used to secure advance storm warnings in order to prepare load dispatchers and repair crews for emergencies. Electronic light intensity meters are placed at four different locations as an aid in determining necessary power requirements.

Ultrasonic testing has been used to find flaws in steam pipes and steam header welds.

A 15-channel magnetic recorder is currently being installed in order to secure information on sequence of operation of system relays and breakers when a fault occurs on the system.

Maintenance . . . Maintenance of these devices is largely a function of failures that have been experienced because of:

1. Faulty fabrication and component deficiencies.
2. Critical circuit designs.
3. Tubes.

Faulty Fabrication and Components . . . For satisfactory industrial application of electronic equipment the quality of fabrication and components must be of the best.

For easy, quick maintenance, all wiring must be neatly dressed and components readily accessible for replacement. In generating station equipment which may be subject to vibration, high ambient temperature, and continuous service, all components should be operated far below rated values, in most cases 50%.

Capacitors probably cause more trouble than any other component. Sometimes these troubles are of the most elusive and obnoxious variety. One common failure is high leakage when exposed to normal high operating temperature. When equipment is removed for maintenance, the temperature goes down and trouble disappears. Judicious use of heat lamp to produce the temperature of normal operating conditions has helped to locate this type of trouble.

Electrolytic capacitors probably cause the largest number of failures. In power supplies oil-filled capacitors are preferred.

Resistors sometimes fail because of failure of the manufacturer to provide sufficient operating tolerance as to voltage and wattage or to anchor properly the resistor to prevent breakage due to vibration. At other times the component drifts, as to resistance, out of proper operating range.

Transformers are not normally fused on the secondary side. Therefore, if an input capacitor or rectifier tube shorts, the transformer overheats and is damaged before the line fuse blows. In some cases it may be desirable to provide secondary fusing.

Selenium rectifiers are not particularly long-lived when continuously operated at full load rating in high temperature environment. Life can be extended if a liberal rating tolerance is provided. It may be more economical and more convenient to replace rectifier tubes as often as every six months rather than to wire in a bank of selenium rectifiers every two years.

Electronics, by amplification, has greatly increased the use of relays and switches. Failure of relay contacts, sometimes of an intermittent nature, are most aggravating. Relay and switch problems can be reduced by putting them on a scheduled maintenance program. Plug-in relays and switches with dust-proof covers that can be removed for inspection and adjustment can be of great help. Adequate spark suppression is needed to reduce arcing to a minimum.

Critical Circuit Designs . . . Some failures are due to poor circuit design. They include:

1. Improper operation because of fluctuating load currents and resultant varying power supply voltages. This effect can be tempered by using a constant-voltage supply transformer and by using voltage regulated power supply.

2. Critical plate, screen and bias-voltages. Wide limits of circuit voltage should be provided to accommodate deterioration of tubes and normal changes of circuit components because of age.

3. High filament-voltage. This is sometimes due to a supply voltage higher than that for which the manufacturer designed. The more frequent cause of these high voltages is light loading of filament transformers. Filament dropping resistors have been installed to reduce these excessive voltages.

Failures Due to Tubes . . . By far the greatest number of failures are caused by tubes. An AIEE committee has been considering the possibility of producing a line of "Reliable" tubes which would have long life, close tolerances and reliable performance. However, for the present it is not feasible from the standpoint of reliability, procurement, or economics to use other than the straight line of tubes except for selected applications.

Tubes are usually in continuous service with no normal interruptions. Tube life is good and usually more than normal life is attained. However, if filament voltage is interrupted, especially after tubes have been in service for several months, trouble can be expected when the equipment is re-energized.

Types of failures most often experienced are:

A. Low emission or low mutual conductance. Tube life as to these characteristics depends upon:

1. Degree to which tube is being worked.

2. Nature or criticalness of circuit.

3. Type of tube.

B. Inter-electrode shorts.

Shorts in tubes are a major difficulty. In generating stations some shorts may be attributed to vibration. In some cases shock mounting has been used. Most common failure is filament to cathode leakage. However, most inter-electrode faults are attributed to defective tubes.

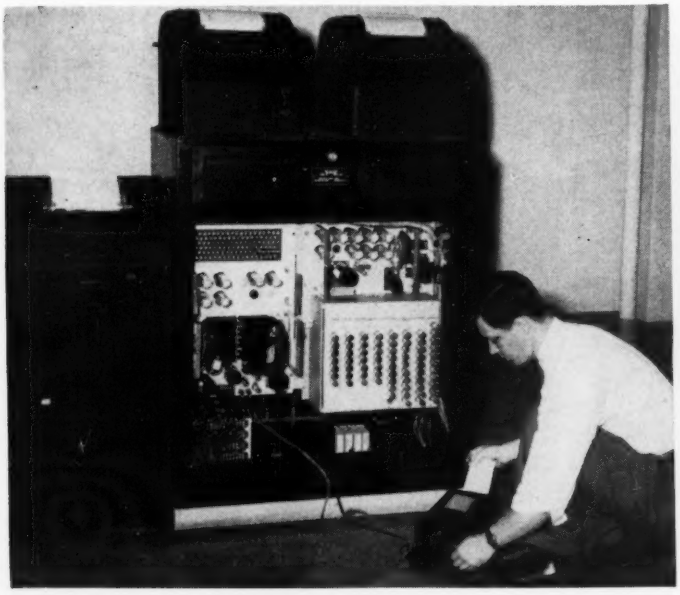
C. Open heaters or filaments.

These faults are rare and easy to locate.

D. Wide variation in characteristics of tubes.

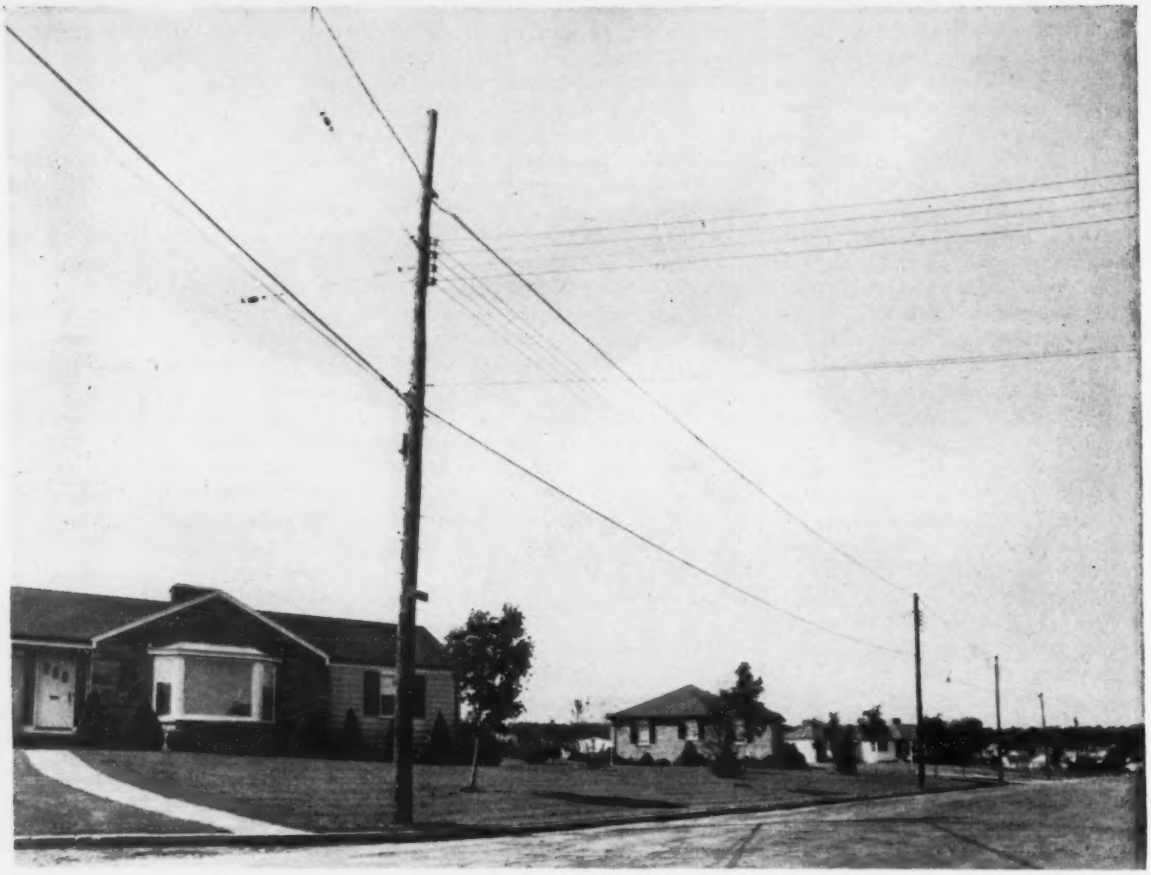
For example, after ten years of satisfactory experience with a particular type of tube in 50 identical amplifiers and with these tubes having been replaced several times

(**Continued on page** 232)

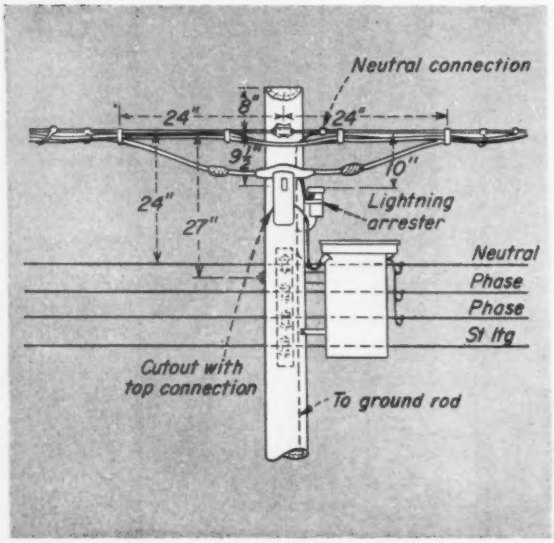


PRINTING AMMETER can print in sequence the load on 60 lines no matter whether they are located nearby or remotely. But a constant check must be kept on it

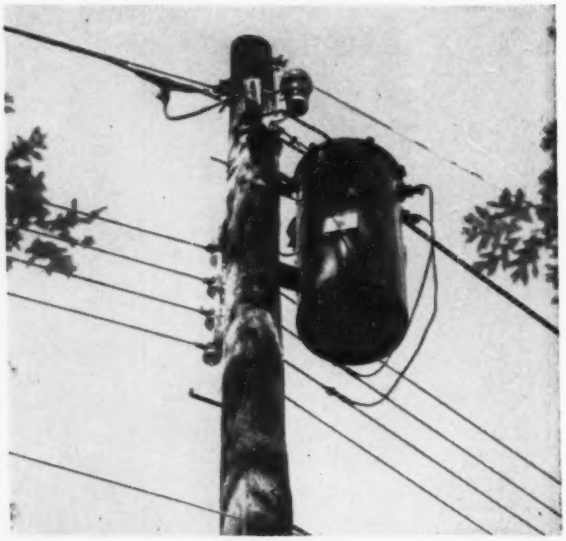
RADIO TRANSMITTER, at dispatching centers is serviced on a set schedule to assure dependability



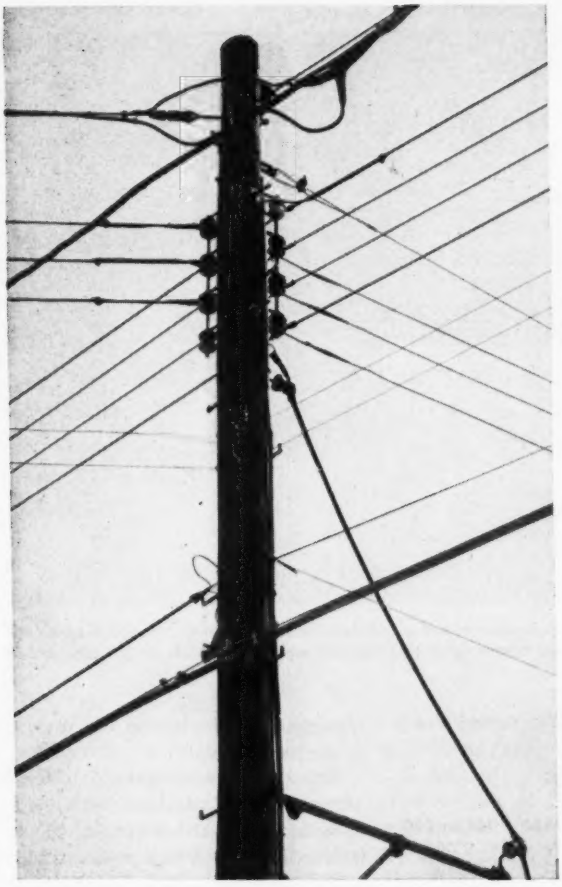
TYPICAL RESIDENTIAL AREA in Cranston, R. I., is served by 4-kv primary aerial cable having shielded reverse lay conductors. Inconspicuous sag and secondary conductors on racks do not detract from the attractive and pleasant appearance of the housing development



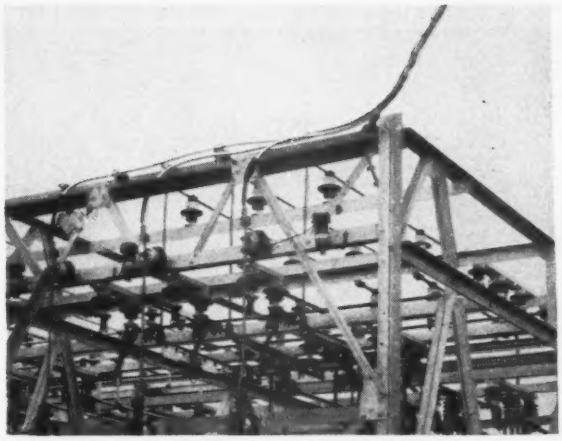
INSTALLATION SPECIFICATION for single-phase transformer rated from 1½ to 37½ kva. Construction applies only to reverse-lay cable which permits use of a cutout having a top connection



ACTUAL INSTALLATION of 25-kva transformer is similar to specification except that this construction applies to conventional-lay cable and a different type of cutout is used



SINGLE-PHASE TAPS are made to three-phase cable through cutouts so that circuit trouble in area served by tap can be isolated easily



CABLE TAKES OFF from the outdoor steel structure at Lakewood substation. This cable is shielded, 3-phase, 4 wire, 5 kv, 4/0 copper

SECTIONALIZING FEEDERS is accomplished with 400-amp solid-blade disconnects. Trees present no stringing problem for cable

Aerial Cable Storm-Proofs 4-Kv Distribution System

FRED SCIOTTI, Overhead Distribution Engineer, Narragansett Electric Co, Providence, R. I.

Aerial cable has storm-proofed a portion of Narragansett Electric Co's 4-kv distribution system. Installation was started in 1946 because of storm damage in 1938 and 1944 and because of the company's vulnerable storm tract location. To date, approximately 127,000 circuit ft (about 425,000 conductor ft) of aerial cable has been installed.

No cable damage has yet been caused by either trees or storms, even during the severe fall storms of 1950. The important by-products of aerial cable design are improved appearance, reduced tree trimming, and less voltage drop. These advantages were weighed against an initial cost of 1½ times that for open-wire overhead distribution.

Type of Cable . . . Pre-assembled 5-kv aerial cable with metallic shielded conductors lashed to a copper-clad messenger by copper ribbon was adopted as "standard." Metallic shielding was specified because it provides better lightning protection and more resistance to corona cutting than does non-shielded cable.

However, the company is using some non-shielded cable on an experimental basis. This was brought about by the difficulty of obtaining adequate tape shields during critical metal shortages and because it is more expensive to tap and join shielded cable than non-shielded cable. A few spans of non-shielded cable that had been in service since 1946 were removed

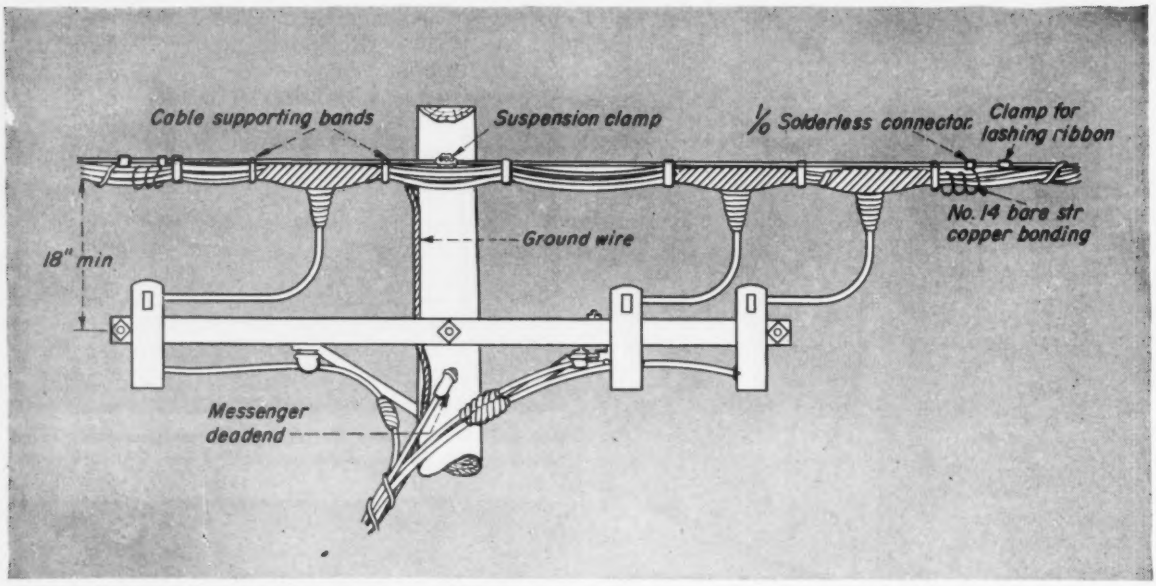


DIAGRAM OF 4/c TAP WITH SECTIONALIZING CUTOUTS is typical of company specifications. Construction standard shows pole top arrangement, and a complete list of material is included. Components are identified so that linemen are certain to use proper construction

Sags for 5-kv, 4/c, 4/0 Aerial Cable

	Temp F	75 to 115	116 to 160	161 to 200
Max tension for ½-in. ice, 4-lb wind..	0	5,260	6,570	8,060
Stringing tension for all spans.....	30	3,800	5,020	6,300
	60	3,500	4,570	5,800
	90	3,000	4,200	5,400
Inches sag for 75-ft span.....	30	8	6	
	60	9	7	
	90	10	7	
Max sag for ½-in. ice, no wind.....	32	10	8	
Inches sag for 100-ft span.....	30	14	11	
	60	16	12	
	90	18	13	
Max sag for ½-in. ice, no wind.....	32	17	13	
Inches sag for 125-ft span.....	30	22	17	13
	60	25	18	14
	90	29	20	16
Max sag for ½-in. ice, no wind.....	32	27	21	17
Inches sag for 150-ft span.....	30		24	19
	60		26	20
	90		28	22
Max sag for ½-in. ice, no wind.....	32		30	24
Inches sag for 175-ft span.....	30		33	25
	60		35	28
	90		38	30
Max sag for ½-in. ice, no wind.....	32		41	33
Inches sag for 200-ft span.....	30			33
	60			36
	90			39
Max sag for ½-in. ice, no wind.....	32			43

Ruling span = average span + ⅔ (maximum span-average span).
Individual spans in excess of 125% of the ruling span should be separately deadended.
In general, secondary wires in the same span will be sagged not less than aerial cable.
Sags are based on an effort to combine optimum appearance and maximum safety factor with sufficient clearance from other conductors in the same spans. Under loaded conditions the messenger will not be stressed in evcess of 60% of its ultimate strength.
Cable weighs 3.49 lb/ft and is supported by a ½-in. 30% EHS copper-clad neutral with an ultimate strength of 20,450 lb.

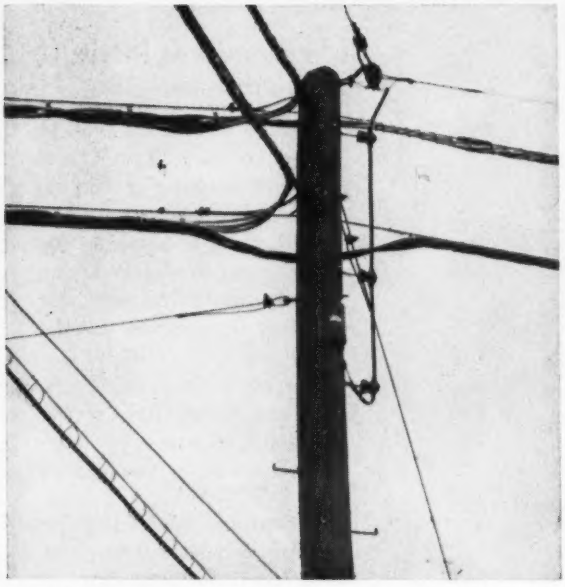
recently. There were no visual signs or corona cutting.

Although cable spinning has some advantages, the decision was made to install pre-assembled cable. It was believed easier to tap pre-assembled cable than to tap spinner lashed cable. Experience has also shown that reverse lay conductors of pre-assembled aerial cable are much easier to work because slack cable is available for splicing and making taps.

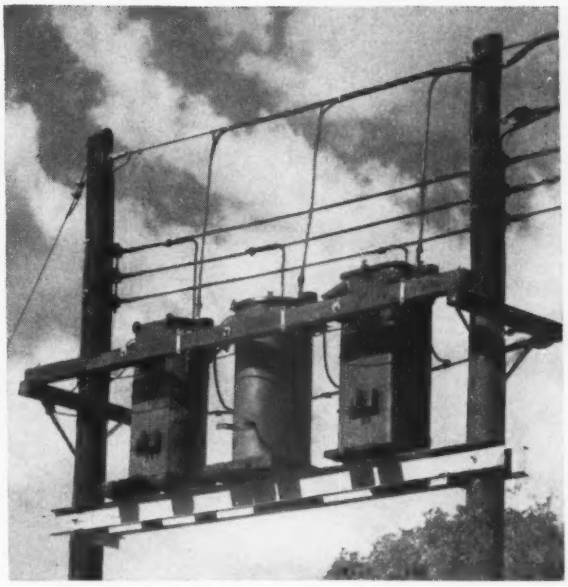
Phase identification of metallic shielded cable is by means of letters embossed on the shielding. For non-shielded cables color coding is either on or under the jacket. Color coding on the jacket has proved better because the jacket does not have to be cut to identify phases.

Installation . . . Because of shortages and the high cost of copper when construction was started, both aluminum and copper conductor aerial cable are being used for feeders. Conductor sizes for these lines are 4/0 copper, and 300,000 and 400,000 cir mils aluminum—all with ½-in. copper-clad messengers. Main feeder cables are four conductor—three insulated conductors and a bare messenger neutral.

Branch lines, on the other hand, are all copper. Their sizes range from No. 6 to 1/0 with ⅜-in. copper-clad messengers. All are preassembled,



NONCONGESTED CORNER POLE has taps off two feeder cables. Sectionalizing cutouts for btoh feeder taps are located elsewhere



AERIAL CABLE TERMINATES at a shopping center transformer bank. Construction is neat and simple. Fused cutouts are on nearby tap pole

and some are non-shielded. Number of conductors per cable is either two or four, including messenger neutral.

Satisfactory splicing and tapping of aluminum cable have been worked out. Splicing sleeves used are hot-tinned copper. One method used to splice aluminum to copper conductors is by means of aluminum and copper connectors butt-welded together. All-aluminum high-pressure connectors are under study.

Guying of aerial cable has presented no problem. Actually no more guying is required with copper conductor aerial cable than for well-guyed open-wire distribution. Because of its light weight, aluminum conductor cable requires less guying than comparable size copper cable.

Narragansett Electric has set up complete specifications for aerial cable construction. Accompanying illustrations show most frequently used practices. Other accepted practices include:

1. Sectionalizing main feeders at 1,000 to 2,000-ft intervals.

2. Connecting all branches to feeders through a fused cutout.

3. Grounding cable messenger at all terminations and at intervals along the run, at least every 800 ft.

4. Installing lightning arresters at all terminations and transformers.

5. Installing aerial cable on street side of pole except at transformer locations, inside angle of corner poles, or to avoid trees.

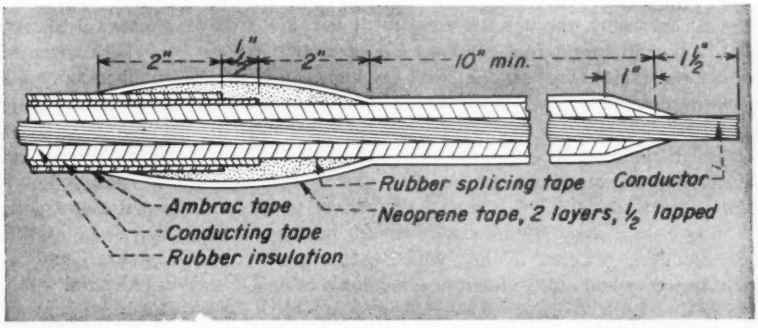
6. Meggering each length of cable after pulling in but before splicing into circuit.

Installation Costs Higher . . . Installed cost for a 4-kv aerial cable line, including poles, is about 1½ times that for an open-wire distribution line. This difference could be reduced somewhat by training linemen to splice cables. Present practice is for underground cable splicers to splice cable working from aerial platforms installed by linemen.

Comparatively high costs for aerial cable are compensated by reliability, appearance, and reduced voltage drop. For 4/0 cable there is about 40% less voltage drop than with similar size open-wire distribution. This will reduce line losses and result in less voltage regulation.

Full advantage could not be taken of aluminum cable's light weight to reduce pole size and cost because most poles are used jointly with the telephone company.

Troubles Are Few . . . Four cases of trouble have been experienced. In one case a faulty "T" splice was the trouble maker. Two faults were due to mechanical damage probably caused by abrasion of binding and shielding tapes either at the factory or during installation. Cause of the company's fourth fault has not been determined.



STANDARD PRACTICE for shielded aerial cable termination is drawn in detail with all parts labeled. Simple but complete instructions are also included for the benefit of workmen

MACHINE SHOP at Norton Co's Worcester, Mass., grinding machine plant has upward component lighting providing 40 ft-c at working plane. Installation has 2,233 units

RLM Standards Institute Specifications

1. *Luminaire distribution* shall be semi-direct with 20 to 30% of the light output directed upward.
2. *Shielding angle* perpendicular to the lamp axis shall be 27 deg below horizontal. No particular shielding is specified parallel to the lamp axis.
3. *Brightness* in the shielded zone shall not exceed 40% of the bare lamp brightness.
4. *Overall efficiency* shall be at least 75%.
5. *Reflectors and shields* shall be porcelain-enameled steel.
6. *Luminaires* shall be designed for two T-12 fluorescent lamps of the 40-w bi-pin type or for 4, 6 or 8-ft slimline lamps.

Upward Component Lighting Can . . .

Increase Industrial Lighting Levels

Sacrifice in maintained foot candles is small. Lamps run cooler because of better circulation, and overall efficiency is increased

W. H. KAHLER, Engineering Section Manager, Lighting Division, Westinghouse Electric Corp, Cleveland, Ohio

The economics of upward component lighting are surprising. In reality, the upward component does not mean a reduction in useful foot-candles. Under certain conditions, maintained foot-candles will be higher with the upward component equipment. Performance records (see chart) indicate that an appreciable upward component in the order of 20 to 30% can be used for optimum maintained illumination values on the work plane. Therefore, with the new designs of industrial fluorescent luminaires the user is in a sense getting something for nothing. And this something is better quality, which means more comfortable seeing and a pleasanter working environment.

More Comfort . . . Experts on vision have long been concerned about the harsh brightness difference between luminaires and dark ceilings. This is especially true of low-bay industrial installations having many units in the normal field of view. For industrial installations direct type lighting was thought to be the only practical method of obtaining efficient illumination. Industrial relations personnel, however, who study the effect of surroundings on work attitudes, production, and quality have believed that lighting could be more comfortable, thus improving working conditions.

To get such conditions designers compromised and produced a fixture which would direct most of its light downward towards the floor but would send a fraction of the light towards the ceiling. These men expected and obtained a much better over-all light quality. They thought it would cost more to obtain a specific level of illumination with this so-called semi-direct light. Under certain conditions upward component construction actually increases the illumination level. In all cases the sacrifice in maintained foot-candles is very small.

Lighting Trend . . . Semi-direct lighting has become a trend in industrial service. Numerous new luminaires are being offered to industry by equipment manufacturers. Upward components vary from 5 to 40% of the total and shielding from 13 to 35 deg. Shielding generally consists of a

PATTERN SHOP lighting at Norton Co illustrates effect of upward component lighting with ceilings and walls painted in light colors

BETTER QUALITY LIGHTING means more comfortable seeing, more pleasant environment. Ventilated luminaires require less maintenance

reflector and a longitudinal element for crosswise shielding only, or louvers for shielding in both directions. Both baked enamel and porcelain enamel are being used.

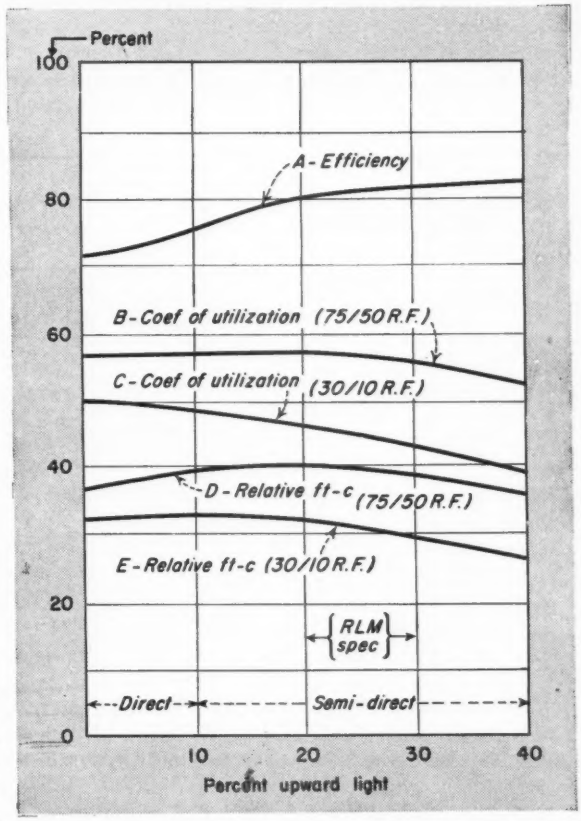
Specifications . . . The RLM Standards Institute has recognized this better quality by setting up specifications after a careful study of the numerous possibilities. Specification points on construction and performance should be particularly interesting to industry because they have been designed to provide better quality illumination without sacrifice of the basic features of conventional luminaires.

Efficiency . . . Illumination performance characteristics are shown in the accompanying chart for a 2-lamp industrial luminaire with longitudinal shield and with variations in upward component from zero to 40%. It covers the complete range of direct and semi-indirect luminaires as specified by the ICI. Luminaires with zero to 10% are classified as direct; from 10 to 40% up as semi-direct.

Openings in the reflector top increase over-all efficiency from 72 to over 80%. Light normally trapped on the lamp top is relieved upward. Lamps run cooler because of better air circulation, hence light output may be increased.

Maintenance . . . For equal amounts of light the direct component has the advantage in efficiency because light does not have to be redirected by absorbing surfaces. However, a white ceiling will provide maximum utilization of the upward component. Numerous studies show that ventilated luminaires collect less dirt than non-ventilated. This is why direct-indirect, louvered, fluorescent luminaires are well accepted from a maintenance standpoint.

In obtaining the relative foot-candle curves of the chart, a maintenance factor of 0.65 was used at 0% up, 0.68 for 6% up, and 0.70 from 10 to 40% up.



PERFORMANCE CHART of 2-lamp industrial luminaire having longitudinal shield and 0 to 40% upward component. "A", maximum improvement in efficiency appears in 0 to 20% upward light range. "B", coefficient of utilization with white ceiling and light walls for reflection factors (R.F.) of 75-50%. "C", as in "B", but for 30-10%

Will Today's Plan for Your Distribution System Be for . . .

Long Range Economy?

What voltage?
What substation size?
What system pattern?

The following technique gives the answers to these questions. It shows how the most economic selections of service voltages and equipment can be made

H. E. CAMPBELL and **E. H. REILLEY, Jr,** General Electric Co, Schenectady, N. Y.

The essence of long range system planning today is the economic selection of system voltage, substation size, and system pattern. The following technique for the establishment and economic analysis of systems for future and existing load areas, covers density determination, feedpoint coverage, voltages, substation size, primary pattern, and existing facilities. It has been applied and proved by application to a large utility system. Re-examination of recommendations for this system showed results to be sound and gratifying.

To establish the final result, this technique initially ignores many of the existing system facilities. Established generating sites, primary voltages, and load densities are subsequently superimposed on the calculated system to arrive at the projected economic system.

Load Density . . . Starting point in setting up a system is to establish the load density to be served. For undeveloped areas, the saturation and characteristics of the anticipated loads will permit density estimates. For areas where there is an established load, load densities may be obtained by adding the distribution transformer ratings in a square mile and applying a load-rating factor to obtain the kva/sq mi for the area.

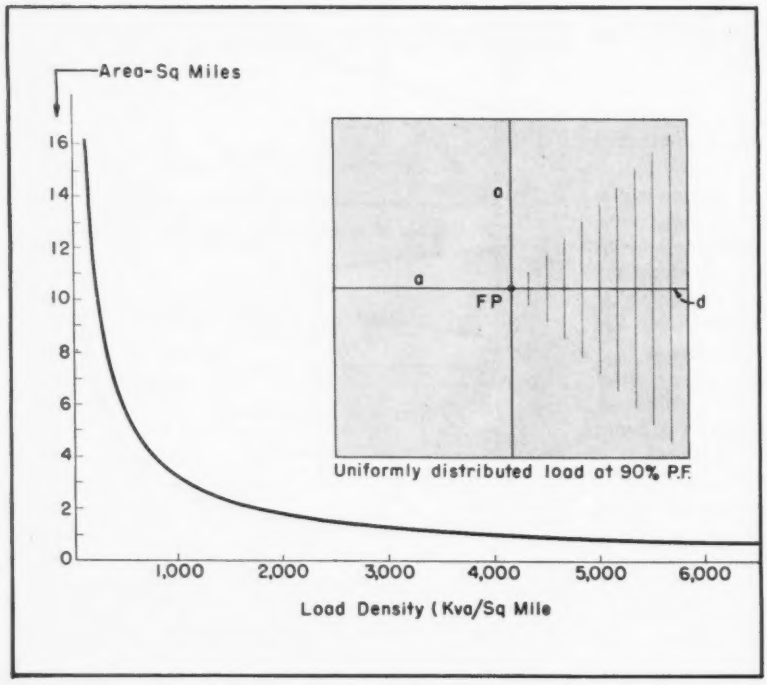


FIG 1—LIMITING AREA that can be adequately served at a known load density is given by this curve which is for 4.16-kv primary with 4/0 mains, No. 4 laterals and which allows 3% voltage drop between first and last distribution transformers. Such a system can be served from one feed point as shown in the insert. The area covered is 1 sq mile

Load Density Map . . . The density, regardless of the manner in which it is established, should be multiplied by a load-growth factor, and the product recorded on a load density map. A load-growth factor of 2 is suggested, particularly for the areas where load will double in ten years. The densities recorded on the map become the basic values which the projected system will have to supply by the end of the planned period.

To determine correct distribution substation sizes and system voltages, it is necessary to work with sufficiently large areas to make effective comparisons between various schemes. It is convenient to consider 16 sq mi areas when studying systems with 4-kv primary. If 12 kv is planned, an area of 64 sq mi may be considered. These areas will be called "unit blocks."

To simplify the mathematics without much sacrifice of accuracy, an average load density of the "unit block" densities is used. The load density map will then consist of "unit blocks" with the average load density per square mile noted thereon.

Primary System . . . The first thing that must be determined in the primary system is how much load can be supplied from a single "feed point." This, is the point from which primary mains and laterals fan out to cover

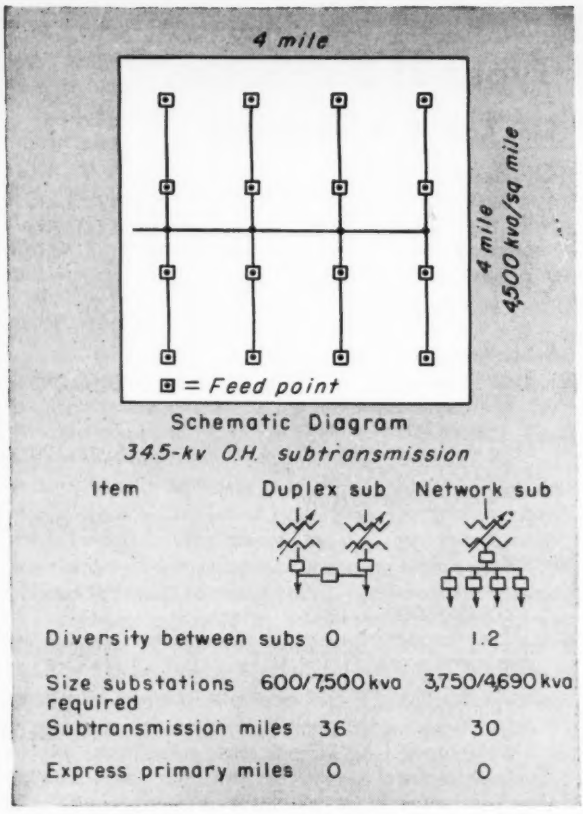


FIG 2—UNIT BLOCK of 16 sq miles has a duplex type or a primary network type substation (34.5/4.6 kv) located at each feed point

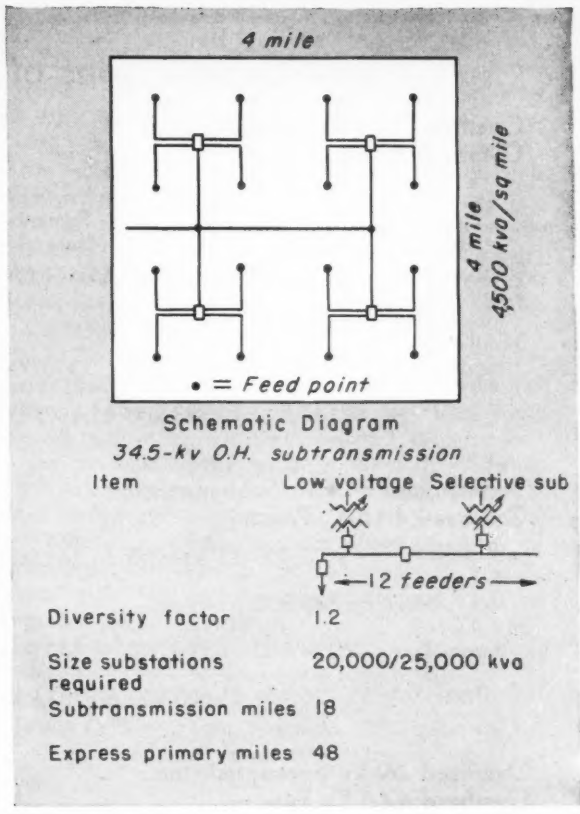


FIG 3—UNIT BLOCK of 16 sq miles has low voltage selective substations (34.5/4.16 kv) located at each feed point

an area to supply distribution transformers. The area served from a single "feed point" depends on:

1. Allowable voltage drop between first and last transformers
2. Wire sizes
3. Power factor
4. Load density
5. Voltage of and distance between laterals
6. Primary voltage

The relation between area and load density is shown by the curve of Fig. 1. An idealized primary system layout is shown in the insert (Fig 1).

A curve like Fig 1 can be derived for any multigrounded primary system voltage by using the equation:

$$\% \text{ voltage drop} = \frac{2DZ_1 \times a^3}{30\ kv^2} + \frac{4.2\ DZ_2 d\ a^2}{20\ kv^2}$$

D = density in kva/sq mile
Z_1 = $(R \cos \theta + X \sin \theta)$ in ohms/mile per main
Z_2 = $(R \cos \theta + X \sin \theta)$ in ohms/mile per lateral
d = distance between laterals in miles
a = miles of main from feed point
kv = line-to-line voltage

For delta systems the multiplier in the second term is 2 instead of 4.2. The first term remains the same.

After determining the relation between "a" and density in this equation, the area vs density is obtained by the equation, Area = $(2a)^2$. With this area-density relation we can now obtain the number of feed points necessary to serve a "unit block." These feed points should be symmetrically located within the block. The next step is to supply these feed points from distribution substations.

To obtain the economical substation size and primary pattern, simultaneous cost consideration must be given to:

1. Subtransmission within unit block
2. Distribution substation
3. Express primary runs

An erroneous conclusion may be drawn if these three items are not considered together.

For all patterns the same service reliability should be maintained for the schemes analyzed. This can be done by adding capital investment in the form of a primary network, or capital investment in the subtransmission and distribution substations in a low voltage selective scheme. The substation sizes can be varied from one substation per feed point to one substation serving many feed points. After selecting a particular substation size the necessary subtransmission and express primary runs follow as a natural consequence.

Area Equipment Estimated . . . The package substation concept has made it possible to study quickly numerous substation sizes, voltages, and arrangements. Figs 2 and 3 show how this is done. Consider a 16-sq mile unit block with a load density of 4500 kva/sq mile. If primary voltage is 4.16 kv, Fig 1 shows that an area of about 1 sq mile can be served from one feed point; therefore, 16 feed points would be required in the "unit block."

It might be desirable to compare the costs of primary network duplex substations, and large low voltage selective substations for supplying

Cost Comparisons of 3 Types of Distribution

Overhead 34.5-Kv Subtransmission
Overhead 4.16-Kv Primary

Item	Low Voltage Selective	Duplex	Primary Network
Substation	$772,400	$1,360,900	$1,167,800
4-Kv Feeders Incl. Losses	880,300	.....	.....
34.5-Kv Subtransmission	234,000	468,000	390,000
Total	$1,886,700	$1,828,900	$1,557,800

Underground 34.5-Kv Subtransmission
Overhead 4.16-Kv Primary

Substation	$772,400	$1,360,900	$1,167,800
4-Kv Feeders Incl. Losses	880,300	.....	.....
34.5-Kv Subtransmission	2,124,000	4,248,000	3,540,000
Total	$3,776,700	$5,608,900	$4,707,800

Overhead 69-Kv Subtransmission
Overhead 4.16-Kv Primary

Substation	$866,900	$1,584,900	$1,281,900
4-Kv Feeders Incl. Losses	880,300	.....	.....
69-Kv Subtransmission	285,000	594,000	570,000
Total	$2,032,200	$2,178,900	$1,851,900

Line Costs (R/W not included)

Overhead

4 kv, 4/0	$11,000/mile
34.5 kv, 4/0	$13,000/mile
69 kv, 4/0	$19,000/mile

Cable

34.5 kv, 750 MCM	$118,000/mile

Substations

Low voltage selective, 34.5/4.16 kv 20,000/25,000 kva, LRC Twelve feeder circuits	$193,085
Low voltage selective, 69/4.16 kv 20,000/25,000 kva, LRC Twelve feeder circuits	$216,720
Duplex, 34.5/4.16 kv 6000/7500 kva, LRC Two feeder circuits	$85,056
Duplex, 69/4.16 kv 6000/7500 kva, LRC Two feeder circuits	$99,059
Primary network, 34.5/4.16 kv 3750/4690 kva, LRC Four feeder circuits	$72,969
Primary network, 69/4.16 kv 3750/4690 kva, LRC Four feeder circuits	$80,120

Losses

Assume equivalent first cost of losses equal to $200 per kw.

4160 volt express feeder, 4/0

Cost of losses per mile

Loss per mile = 36.7 kw

Cost of losses per mile = 36.7 × $200
= $7,340

these feed points. Fig 2 shows the primary network or duplex substations located at each feed point and the summation of the equipment required. The same thing is shown in Fig 3 for the large low voltage selective system. Note that the primary from the feed point to the distribution transformers does not have to be considered because it is common to all systems. A cost comparison of these schemes and unit costs are shown in the tables. When the subtransmission and primary are overhead, comparison shows the primary network to be the least expensive. However, with the subtransmission underground and the primary overhead, the large low voltage selective system is less expensive. With both subtransmission and primary circuits underground the low costs would probably swing back in favor of the primary network.

The value of losses in the primary express runs should be taken into account as in this example. These losses can be the reason for the large substation scheme being expensive in a cost comparison.

The effect of other subtransmission voltages on these costs can be determined by repeating the procedure. This has been included in the table for 69 kv and shows the penalty which must be paid for the area coverage part of the subtransmission at a higher voltage.

Of course, there are other things besides these cost comparisons which must be considered before deciding in favor of one or the other system. Such things as (1) congestion of the 4.16-kv circuits out of the large substation, (2) whether or not the express-runs out of the large substations can be bus regulated satisfactorily, (3) will more money have to be spent for individual feeder regulators, and (4) can investment be deferred by buying small substaticns. Each has an influence on deciding which scheme would be best. However, the object is to determine the locations to which subtransmission must be run. Good judgment with these costs as a guide will locate the substations on the load density map.

Subtransmission Selections . . . The subtransmision will take power from either a generating plant or a large step-down substation on a transmission line. This source of power might be within the "unit block" or some distance away. If it is within, then the economic voltage found in the primary system section will be correct. However, if the subtransmission will be used for some distance to get between

the source of power and the area considered, then another look must be taken to find the economic subtransmision voltage.

The money saved by fewer higher voltage circuits for distance coverage might more than offset the higher costs of higher voltage substations. As an example, from the cost comparisons in the table, the 69-kv subtransmission ranges from $150,000 to $350,000 more expensive than the 34.5-kv scheme. If this amount can be saved in distance coverage by using fewer 69-kv circuits instead of 34.5 kv, higher voltage may be attractive.

A layout of the circuits needed to supply the substations at applicable voltage should be made with little regard given to the actual routing of these circuits. They should be run anywhere within reason to realize an abstract approach to this problem.

Consideration should be given to the pattern of the subtransmission circuits. These circuits can be a loop or parallel pattern. The loop pattern is one in which each circuit supplies several distribution substations and then is run back to the source. Enough breakers must be used to sectionalize the loop and assure continuity of service to each substation.

In contrast to this the parallel pattern is one in which duplicate subtransmission circuits are run to each substation. Here the subtransmission breakers can be eliminated at the substations. For overhead circuit the parallel pattern is usually most economical except at light densities, such as 200 kva and below. Even at the light densities there is very little cost difference between the two schemes. However, for underground circuits the loop pattern has a cost advantage for densities below 4000 kva/sq mile. The parallel pattern has economic advantages at the higher densities.

With this as a guide, a suitable subtransmission system can be laid out on the load density map between the source of supply and the distribution substations. Enough circuits must be installed so that they can not only carry normal load but will be able to carry emergency load. An emergency will be one circuit out of service.

This should be done for each subtransmision voltage which might be applicable. A cost comparison can be made between them to determine which is the most economical. This will also reveal whether there is enough money saved in the distance coverage of a higher voltage system to more than compensate for the higher cost of this system in the area coverage part, shown in the table.

Transmission . . . If a subtransmission system is supplied directly from generating stations, it might be called a load-area generating system. Here transmission lines are not normally used to transmit power. They only tie stations together for emergencies. And then only enough circuit capacity is needed to allow the two largest machines to be out of service at once.

Layout and cost of such a system is quite simple. Transmission cost is a minimum. But subtransmission system cost is high because it must carry power some distance to the load. But it is applicable only where generation can be close to the load.

Where generation has to be remote from the load area, backbone transmission may have cost advantages. Such systems are designed to carry bulk power to large step-down substations which supply the subtransmission system. Savings in distance coverage of subtransmission, like this, have to compensate for the step-down substation to have a cost advantage over area generation.

Several transmission schemes should be laid out for comparison.

Total System . . . With estimated cost of various components of each scheme derived, it is a matter of adding them together for an overall cost. Fig 4 shows how the components fit together. Combinations to be investigated are best left to individual judgment. A particular study, will usually settle down to two or three combinations which should be studied in detail.

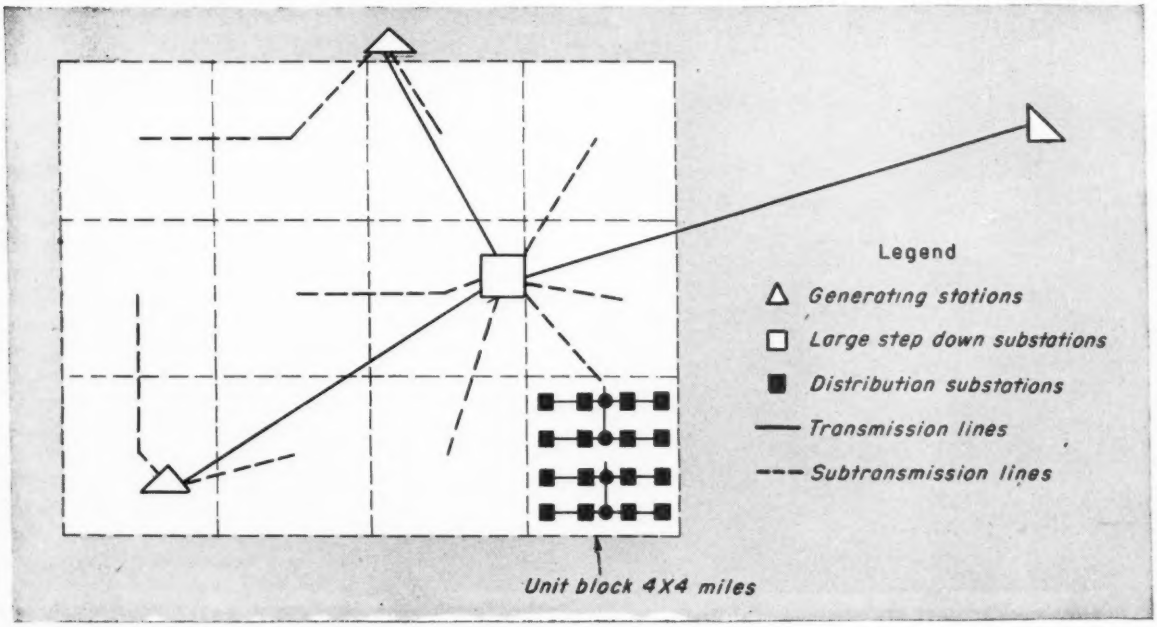


FIG 4—SCHEMATIC DIAGRAM of the system shows the power lines running from the generating stations to the various feed points

Microwave . . .

The Backbone of

Telemetering, telephones, powerline carrier, and facsimile, will also be extended. Efficient operation necessitated added facilities

G. EVERETT FARMER, Chief, Communication Engineering Branch, Tennessee Valley Authority, Chattanooga, Tenn.

TVA's planned system expansion from 4 million to nearly 10 million kw has made necessary an equivalent expansion of communications facilities used in system operation. More than 6,000 miles will be added to the existing 11,000 miles of telephone circuits. There will be corresponding increases in other communication services, including telemetering, load control, pilot relaying, supervisory control, teletype, and facsimile.

Development of the TVA communication system was spurred by the need for reliable and instant communication in operations associated with the generation and transmission of an unprecedented volume of electric energy. Quick mobilization of men and equipment in emergencies also depends on good communications.

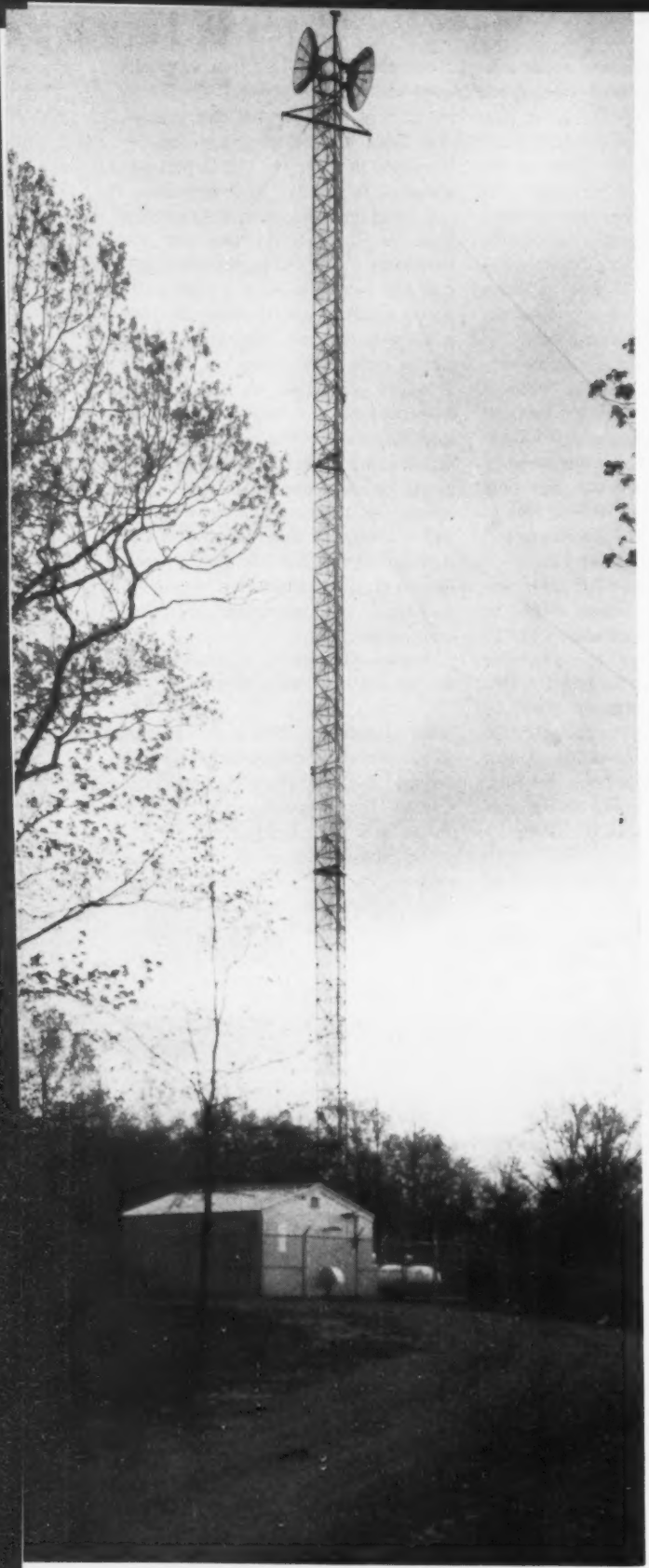
This program presented a number of engineering problems. These involved the relative costs and comparative service reliability of different types of facilities, the communication use and availability of newly developed equipment, and timing of the projects for coordination with the power services.

Communications networks had to be expanded to include five large steam generating plants under construction, two proposed ones, two hydro plants, a number of new substations, and additional power system dispatching centers.

Microwave System Will Be Widespread . . . Major expansion will be by microwave. Six microwave links, requiring 16 repeater stations and totaling 497 route miles, are now being installed. Each link, although using only four to seven circuits initially, will have an ultimate capacity of 24 to 30 voice circuits, with a possible addition of as many as 19 pulse channels on any one voice channel. These new microwave channels will augment existing services from the chief power system dispatcher and operational supervistors in Chattanooga to the other dispatching points, district operating offices, power plants, and substations.

Chief reasons for the use of microwave in this expansion are the lower cost per circuit mile compared with other types of facilities and the frequency congestion in the power line carrier spectrum. Although microwave will take the lion's share of the expansion, each of the existing types of communication will also be expanded.

Public Telephone a Supplement . . . Public telephone service will be used as in the past at practically all generat-



TYPICAL TVA MICROWAVE STATION consists of steel tower and building housing radio frequency equipment and power generator

TVA's Expanded Communications

ing plants and substations to supplement TVA-owned services. The two services are completely independent in every way to afford the maximum in reliability through alternate routes and equipment. Primary purpose of the TVA-owned telephone system is to provide direct and instantaneous service with a high degree of reliability from the operating centers to various operating points.

TVA has 3,000 miles of open wire or underbuilt telephone lines. There will be little expansion of these because of the high cost of construction. However, some existing circuits will be routed into new stations.

Underbuilt telephone circuits have played an important role. With improved methods for transposing, the noisy "hot line" has become a thing of the past. Although these lines have provided good grade circuits for local service, their chief advantage is in the use of carrier superposed upon them.

Carrier Boosts Wire Channels . . . Open-wire line with carrier telephone channels forms the backbone of the present TVA telephone system. Practically every telephone line has carrier of the one-, three-, or 12-channel type superposed upon it. The three-channel system is used to a great extent, with only a limited amount of the 12-channel type because of interference between this type and paralleling powerline carrier channels.

For the most part, these carrier circuits makes up trunk connections between the communication centers. With them it has been possible to engineer the entire telephone system on a maximum circuit net loss of 20 db between operating points with circuits in tandem. Seventy-four miles of underbuilt line were installed from Columbia, Tenn., to the Johnsonville steam plant, and three-channel carrier systems were added to this line, to the Columbia-Nashville line, and to the Chattanooga line to provide 6 db trunking circuits from Johnsonville to Columbia, Nashville, and Chattanooga. However, three powerline carrier telephone channels over different routes were also brought to Johnsonville Plant to provide circuit diversity.

At Widows Creek steam plant adjacent TVA-owned telephone lines were routed into the plant, but they were already fully loaded with three-channel systems. By rearranging this service and adding a 12-channel type system superposed above the three-channel system, the necessary circuits were provided.

Powerline Carrier . . . The bulk of the telephone traffic is now carried on the telephone lines. But powerline carrier

FOUR KEY-TYPE TELEPHONE SWITCHBOARDS in Chattanooga load dispatcher's office give him direct connection to the far corners of the system. There are four dispatching centers of this type now in service on the system. Others are planned as part of the expansion program

TVA-OWNED TELEPHONE CIRCUITS are interconnectible at each switching point through key-type switchboards mounted in the desks of the substation operators or power dispatchers

SEPARATE CORD-TYPE SWITCHBOARDS have been installed. They are operated by in-

channels, in addition to providing some primary trunks, also provide alternate channels with a high degree of reliability to all important operating points.

Because of the congestion of frequencies, powerline carrier is used primarily for pilot relay, telemetering, supervisory control, and a limited back-up system of telephone.

Over 50 powerline carrier telephone terminals, 40 powerline carrier narrow-band, frequency shift, telemetering terminals, and 100 powerline carrier pilot relay terminals will be used in the expansion. The telephone terminals will be of the frequency-modulated type as they permit maximum use of the frequency spectrum on the TVA system.

This proposed increase in the powerline carrier facilities has been made possible mainly through the development by one manufacturer of a telephone terminal using relatively sharp filters and circuit refinements which permit much closer spacing of the channels. Furthermore, use of so-called broad-band coupling has been of some help in utilizing the carrier spectrum to a better advantage. But the full advantages of this coupling cannot be obtained with presently available carrier line traps.

Microwave Installations . . . The first microwave links being installed are Chattanooga-Wilson, Wilson-Jackson, Tenn., Chattanooga-Nashville, Chattanooga-Knoxville, Chattanooga Power Building-Chickamauga Dam, and Kentucky Dam-Calvert substation.

In expanding the system, links will also be added between Wilson and Colbert steam plant, between Nashville and Shawnee steam plant, and between Knoxville and the new steam plant at Rogersville.

Some of the new circuits will provide direct telephone service from Chattanooga to the new steam plants. At least two circuits will connect to each plant, one to the control room and one for dialing through the plant PAX. Others will augment the trunks between the wire centers and the circuits between the new dispatching centers. Facsimile, telemetering, and teletype circuits also will be carried over these circuits.

Each terminal and relay station will be equipped with auxiliary transmitters and receivers. These will be cut into service automatically upon failure of the primary units.

A gas-driven engine generator will be provided at each relay station for automatic operation upon failure of the normal power supply. Stations through which telemetering channels will be routed will be equipped with storage batteries and three-unit, ac motor-dc motor-generator sets, in addition to the gas-driven engine generator, to provide interruption-free service.

Secondary lightning protectors will be installed in the incoming power supply leads at all relay stations.

Switching and Signaling . . . Switching at substations and stations is done at boards in stations and dispatching centers. Each of the new generating plants will also have an automatic private branch exchange of at least 100 lines.

All carrier circuits are operated as magneto circuits except a few of the original dial-calling, single-frequency powerline carrier channels and those terminating in generating plant automatic exchanges. Special equipment was developed by TVA maintenance engineers to accomplish signaling on the magneto circuits.

Mobile Radio Covers 80% of TVA Area . . . The mobile radio system now covers approximately 80% of the TVA territory. It consists of 42 fixed stations and 322 mobile stations. Several stations will be added in this program to extend the coverage, and terminals will be added at most of the large steam plants to provide an emergency contact in case of a major communication disruption. Several antenna sites are being coordinated with microwave relay stations to take advantage of the tower, the power supplies, and buildings.

Telemetering of the High-Speed Type . . . The telemetering system now consists of over 3,700 miles of pulsing channels, the major portion of which are carried on powerline carrier channels. Indications of power interchange with adjacent utilities and the output of generating plants are carried on narrow-band frequency-shift channels to accumulating centers. From these they are routed through group channels to the Chattanooga office. The interchange readings are totalized here and retransmitted on automatic load control channels to the regulating plants.

Telemetering additions will consist for the most part of informational readings from generating plants and extension of load control channels to new plants. Alternate

dependent telephone operators at locations where traffic is such that substation operator or dispatcher is too busy for work

circuits will be provided for these services over microwave.

All telemetering and load control circuits are routed through jacks at the plants and substations where channel facilities are terminated to provide flexibility in testing and routing this service. Telemetering connected with automatic load control is of the high speed or continuous type, operating on 20 to 25 cycles. Some informational readings use the older impulse duration instruments.

Teletype . . . Teletype or printer telegraph service now connects the Chattanooga offices with Wilson and Nashville dispatching offices, Johnsonville and Shawnee steam plants, and Jackson, Tenn., and Nashville construction offices. This service will be extended to all new steam plants and new dispatching centers. In most cases these circuits are superposed by so-called "speech-plus-duplex" or tones upon one of the direct telephone circuits.

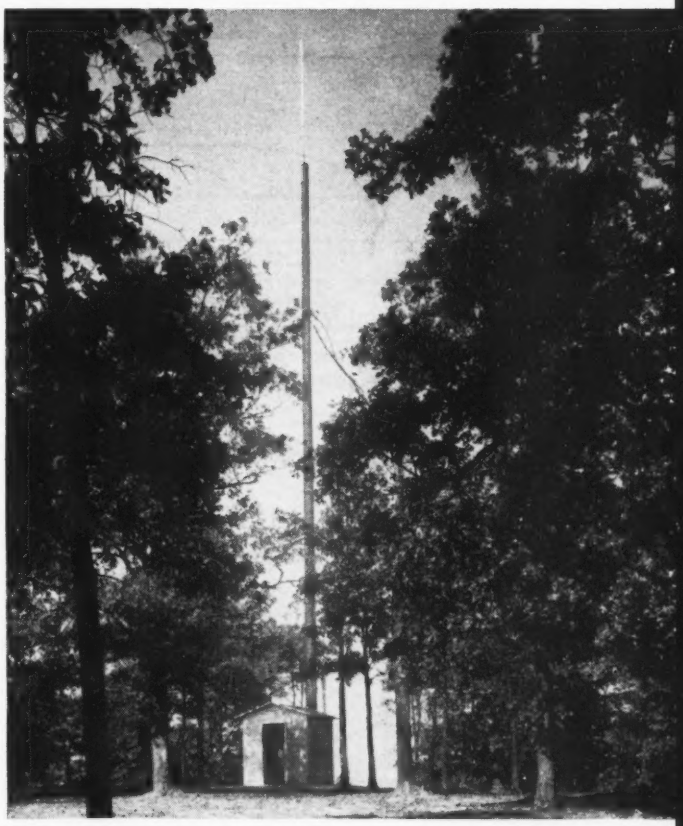
Facsimile . . . One facsimile channel now connects the Chattanooga and Wilson dispatchers' offices. Additional channels will be provided to all dispatching offices to permit transmission of log sheets, switching diagrams, weather information, and other data. This requires a full telephone channel for operation.

Pilot Relaying . . . New 154-kv transmission lines will be protected by powerline carrier pilot relaying. This will utilize narrow-band units without auxiliary telephone service to conserve the frequency spectrum area.

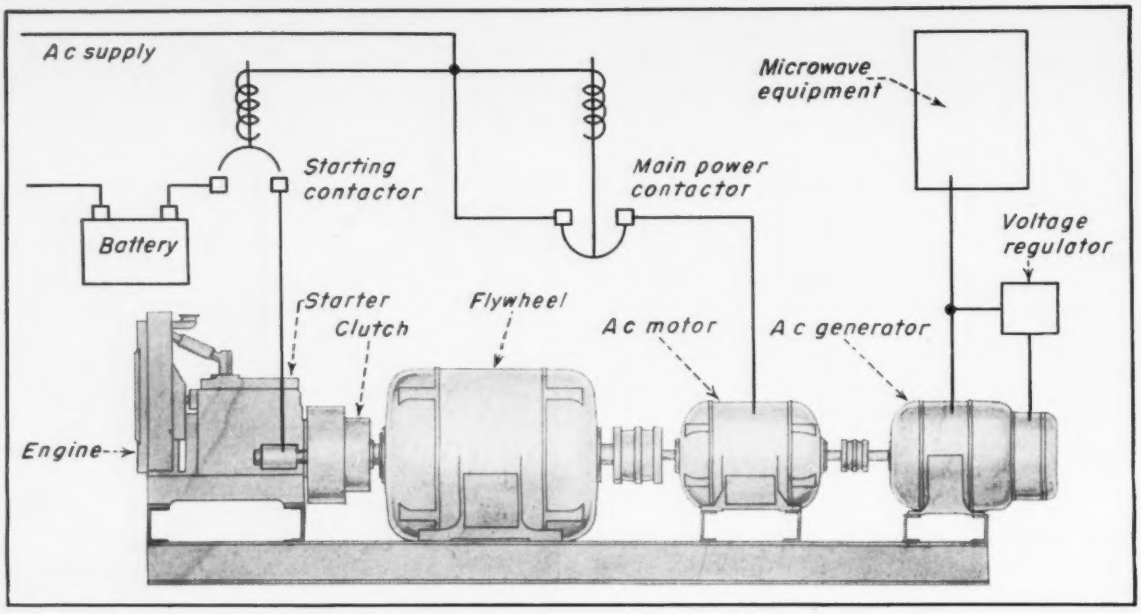
Carrier terminals, telephone relays, and associated equipment at each plant and major substation are installed in a separate communication room on open-type, standard 19-in. equipment racks. All circuits are equipped with in, out, and bridge jacks to permit simple testing and patching of the circuits.

Supervisory Control . . . In the TVA expansion program automatic substations are preferred. But remote supervisory facilities are considered, and in many cases used where supervision is required. Channels used to provide this service may be telephoneline carrier, powerline carrier, microwave, or cable. In each case, the cost, reliability and availability, especially of powerline carrier frequencies, must be considered.

SIGNALING ON MAGNETO CIRCUITS is through code selector limiting signal to individual station desired and gives a reverting signal

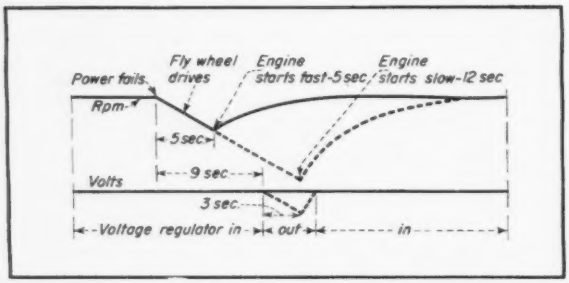


FIXED STATION TO MOBILE RADIO now covers 80% of vast TVA area. But plans now call for expansion of all communications facilities

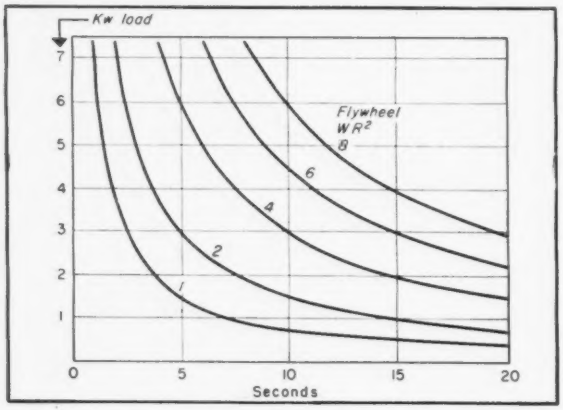


For microwave systems . . .

EMF Unit Supplies Reliable Power



GENERATOR RPM and frequency decrease after ac supply interruption but EMF unit maintains voltage until engine attains normal speed



FLYWHEEL SIZE for EMF unit is determined by the microwave load and the time required to start and accelerate the emergecy engine

BRUCE W. DAVID, Manager, Wire Relations & Radio, Cleveland Electric Illuminating Co, Cleveland, Ohio

A reliable source of noninterrupted power for microwave stations has been found in an engine-motor-flywheel (EMF) power unit, a triple source of power. It has been designed specifically for microwave protective relaying of transmission lines.

The new unit solves the power supply problem for microwave equipment in remotely located transmission substations or switching stations. Usually ac power for these stations is available only over the transmission line to be protected or a long rural distribution line.

Until the EMF unit was developed, other types offered partial solutions to specific supply problems. Brief interruptions of 5 to 50 seconds may be permissible in microwave communication. An auxiliary gasoline engine driven generator can start quickly, resulting in loss of only a small portion of the message. Such an E power unit is usually standard at unattended two-way radio stations.

Normally the microwave equipment is energized directly from the ac supply line through contacts of a magnetic switch. If ac supply fails, starting switch contacts close; and the engine is cranked from a small battery. When the unit is up to speed, the generator ac output voltage is controlled by a regulator. Output is switched to the microwave equipment by a timer-operated transfer switch. Emergency power lasts as long as the gasoline.

But protective relay service cannot tolerate even short interruptions; so a motor-motor power unit is connected to the microwave equipment at all times. The ac generator

is driven by a motor energized from a local ac source. Power failure in this source releases two magnetic contactors. One disconnects the ac motor; the other simultaneously connects the dc motor to a storage battery.

During transfer from ac to dc drive, inertia of three armatures on the same shaft prevents an appreciable drop in speed, frequency, or voltage. But there are drawbacks:

- Storage battery must be able to supply power during the longest outage or consecutive outages of the ac supply.
- Battery charging provisions are large and costly. If the dc motor is used as a charging generator, control problems become difficult. An engine-driven ac generator would still be required in case the battery cannot supply energy during a continued outage.

A motor-flywheel + engine power unit combination eliminates the storage battery and dc motor problem. The microwave equipment is normally supplied from the ac generator of the MF power unit. A motor energized from the ac supply line drives the generator.

When ac supply fails, a gasoline engine starts cranking. Meanwhile the ac motor is disconnected from the line, and its drive for the ac generator is taken over by a large flywheel on the same shaft.

Before the flywheel speed drops to a minimum acceptable rpm for generator voltage and frequency, the engine of the separate E power unit will have reached a speed high enough to take over the auxiliary supply. A timer on the transfer switch then cuts in the output from the generator on the E unit.

Objectionable features are these:

- Duplication of ac generators.
- Transfer switching time and control problems.

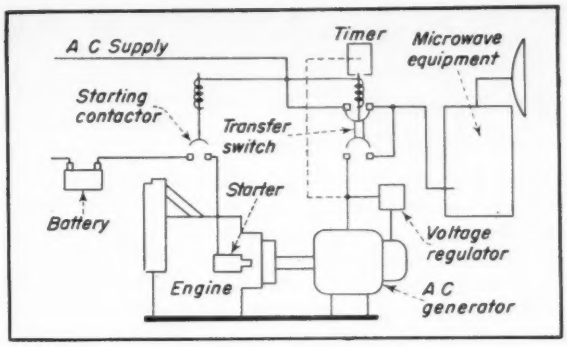
EMF Is Answer . . . Combining essential functions, the engine-motor-flywheel power unit eliminates complicated controls and duplication of components. The microwave equipment is continuously supplied from the ac generator, normally driven by the ac motor. Supply line failure closes a switch to crank the engine. And a magnetic contactor disconnects the ac motor from the supply line.

While the engine is starting, a specially designed flywheel provides continued drive for the generator. This flywheel is solidly coupled to the motor and generator. The engine is connected by an over-running clutch, thus permitting the engine to remain at standstill until needed for emergency power. The clutch permits free and quick starting because it will not pick up load until engine and generator rpm are equal.

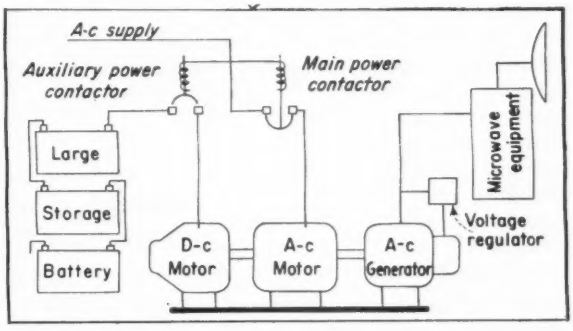
Dependable starting and load pickup can be obtained if:

1. A minimum room temperature of 50 F is maintained by a thermostatically controlled space heater.
2. A water jacket temperature of 110 F is maintained by a thermostatically controlled immersion heater.
3. The engine is run for at least 15 minutes a week.
4. A laboratory-tested non-varnish forming gasoline or bottled gas is used.

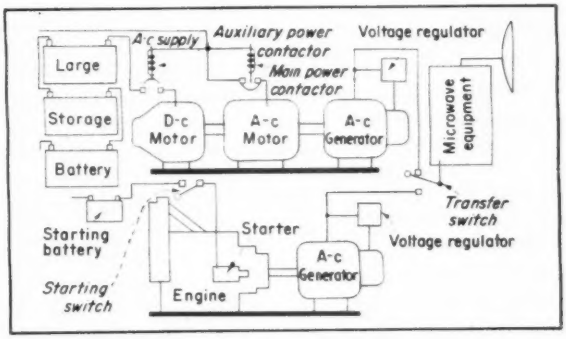
Flywheel Bridges Gap . . . The WR^2 of the flywheel is sufficient to carry the full-rated load of the generator until the engine is started. If the microwave equipment requires less than full load rating, available flywheel carryover time will be lengthened and engine-starting factor-of-safety increased correspondingly. The exciter, ac generator, and voltage regulator are coordinated to maintain constant output voltage during transition to engine drive.



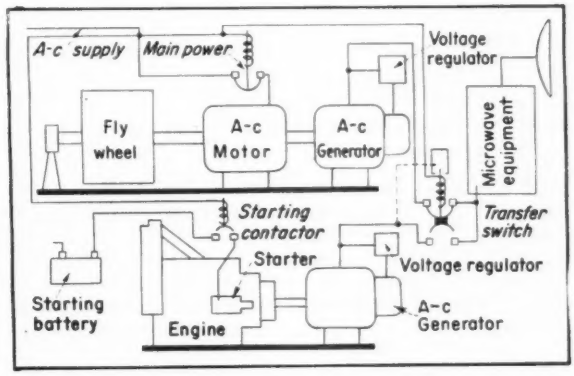
CONVENTIONAL E POWER UNIT is satisfactory for voice microwave stations but fails during time required to start engine so . . .



MM POWER UNIT is continuously coupled at some protective relaying microwave stations. The battery charge is limited, and . . .



MM + E POWER UNIT sometimes is used because standby engine carries through prolonged outage. Battery can be eliminated by . . .



MF + E POWER UNIT with flywheel to spin main generator until engine starts. But transfer switch and extra E Unit are troublesome

GPU Names Jamieson to Aid Area Development

General Public Utilities Corp is developing a program for aggressive promotion of areas in Pennsylvania and New Jersey served by its five subsidiaries. As the first step in this program William J. Jamieson was appointed director of area development.

In New York A. F. Tegen, GPU president, said, "I believe that our service area, stretching from the Great Lakes to the Atlantic Ocean, is one of the finest sections of the country for working, living, and playing. I expect that our new program will lead to extensive promotion of the natural resources, the splendid transportation, the ideal market conditions, the cosmopolitan character of the people, and the recreational advantages of the area."

A complete survey, with attention to available industrial sites and the general economy of the region, will precede final development of the program early next year. Cooperation at local levels will be stressed.

Jamieson was manager of the industrial department of the C. B. Snyder Co, Hoboken, N. J., before joining GPU. He had previously worked for the Garibaldi Realty Co of Hoboken and Public Service Electric & Gas Co. His activities will cover the systems of Northern Pennsylvania Power Co, Pennsylvania Electric Co, Metropolitan Edison Co, New Jersey Power & Light Co, and Jersey Central Power & Light Co.

Final PIP Workshop Program Announced

Final arrangements for the PIP Workshop Conference have been announced by John E. Canfield, chairman. They include a few additions and minor changes to the program previously announced (EW, Oct. 5, p 102). The workshop will be held Oct. 22-23 at the Edgewater Beach Hotel, Chicago.

George H. Tuttle, public relations director, Detroit Edison Co, has been added to the panel on "Informational Aspects of Nuclear Energy."

There will be a presentation of Better Living Television Theater at the end of the first afternoon's program. This will be followed by a hospitality hour and a dinner at which Clarence A. Davis, solicitor of the Department of the Interior, will speak.

Harold Anderson has replaced Randall Johnson on the panel discussion, "Working with Organized Youth Groups." Both are from Washington Water Power Co.

Dallas E. Foreman, Dayton Power & Light Co, and Donald J. McGowan, Consumers Power Co, have been added to the panel on "Organization of an Employee Speakers Bureau." Les M. Taylor has replaced Herbert Shaddix. Both are employed by Mississippi Power & Light Co.

Georgia Power Co Backs 2 Grazing Competitions

Prizes totalling $1,425 will be awarded in two grazing contests sponsored by Georgia Power Co in cooperation with the department of vocational agriculture, State Department of Education. The contests are for members of the Future Farmers of America and of the New Farmers of America. Both competitions are for the development of winter pastures. This is the sixth year for the FFA contest, the third for the NFA.

The winners of the FFA competition and their advisers will get $1,075. The NFA awards total $350.

State and district winners in the contest will be the members of the two groups whose projects are carried out according to the best practices for selection and preparation of land, seeding, plant stand and species, fertilizing, liming, soil analysis, management, utilization, scope and records. Prizes will be awarded next summer.

Aiding the New Customer

Taking advantage of a readymade opportunity, Florida Power & Light Co is presenting each new customer with a collection of folders and booklets assembled in an attractive envelope. The literature is made up of pieces of interest to the householder, tells him how the company can be of service, and promotes the use of electric appliances and lighting.

PIP Atomic Energy Kits Now Available to Industry

An Atomic Energy Information Kit to be used in the Electric Companies Public Information Program is now being distributed to participating companies. It is the first such package ever prepared by an industry.

The 15 sections contain speeches, booklets, background information, suggested articles, material for exhibits, and a bibliography covering films, articles, and books in the field of atomic energy. The information was prepared so that PIP companies could present the nuclear energy story to employees, stockholders and customers.

Prepared by Bozell & Jacobs, counsel for PIP, the material was cleared for public use by the Atomic Energy Commission. Final revisions were made under the direction of Gordon R. Molesworth, formerly assistant to the manager of AEC's Oak Ridge Operations in charge of public relations and now director of the Nuclear Energy Information Division of Bozell & Jacobs.

Each PIP member will receive two kits without charge. Additional copies will be available to PIP members at $3.50 each plus postage. Others may buy kits at $8 a piece from Bozell & Jacobs, 2 West 45th Street, New York 36, N. Y.

SCANNING THE ADS

Alabama Power Co—"What are the great fields of opportunity in engineering?" asks the company in an ad designed to attract high school students to the engineering profession. The copy is illustrated by pictures of engineers working in the five main fields of engineering. The copy is written in a friendly tone.

Philadelphia Electric Co—"Each week . . . $1,000,000 to provide more power for you" is head on ad stressing company's construction program.

West Penn Electric System—Hometown workers are a vital element in plant success an area development ad points out.

WASHINGTON COMMENT

JESSE MOCK

Co-ops Leery of Republican Power Policy

From the regional meetings of rural electric co-op members being held this month, the administration and Congress will get some idea of the grass-roots impact of new policies and attitudes in the federal power field.

Rural Electrification Administrator Ancher Nelsen is on hand at most of these regional meetings to bring back a first-hand impression. But whether he attends or not, he and other administration officials are keeping a close eye on what is going on.

These are the annual area-wide get-togethers of the National Rural Electric Cooperative Association which maintains one of the more active lobbying organizations in Washington. While considerable time is spent at the meetings on local and organizational problems, more attention is focused on the action of the federal government in the power field.

Continual Controversy in a Routine Way . . . As the meetings continued in Oklahoma and Texas last week, they appeared to be settling down to a routine. NRECA Executive Manager Clyde T. Ellis, in his annual reports, was critical of the course being pursued by the Republican administration in matters affecting electric cooperatives. He hit hard at Interior Department power policy, at cuts made in the REA personnel budget. REA Administrator Nelsen answered him, explaining the reasoning behind some of the emerging policies affecting co-ops.

Reports reaching Washington from diverse sources agreed generally on these points:

- Many co-op members attending the meetings are wary of the Interior power policy, fearful it will slow or halt the expansion of co-ops dependent on federally produced power.
- Nelsen is making an excellent impression on delegates at the meetings, and his speeches are reaching attentive audiences.
- Care is being taken to avoid any open clash of personalities between Nelsen and Ellis, both preferring to keep their differences confined to policy issues.

Resolutions Indicate Co-op Attitudes . . . Ellis' critical attitude of the emerging Eisenhower policies is shared by a large group of the delegates attending the regional meetings. This is evident in the resolutions voted out.

The Region VII meeting in Cody, Wyo., resolved to ask the administration to rewrite its power marketing criteria for the Missouri River basin projects. Delegates did not like the requirement that co-ops be limited to blocks of power which they can buy at the time a project goes into production. They want to retain the right to increase their take of power over the years to meet mounting loads, even though this means withdrawing blocks of federal power from non-preference customers such as electric companies.

At the Region I meeting in North Carolina, delegates asked the Eisenhower administration to reconsider its apparent "slowing down of water power resource development" and to sponsor construction of additional steam generating stations for the Tennessee Valley Authority.

Delegates at the Region IV meeting in Michigan voted to have an NRECA committee inform administration leaders of their concern that the federal policy favors "Commercial utilities . . . at the expense of cooperative enterprise."

A resolution passed at the Region II meeting in South Carolina calls on Interior Secretary Douglas McKay to support actively contracts which permit co-ops and other preference customers to buy the output of the Clark Hill project.

But there were also resolutions pledging cooperation with Nelsen and REA and an occasional standing ovation for the new administrator.

On the surface relations were cordial between Ellis and Nelsen during the series of meetings. They posed together for countless pictures and chatted together frequently.

When they got up to talk, though, the conflict was there. Nelsen was selling the new power program of the Eisenhower administration. Ellis was skeptical of it.

TECHNICAL NOTES

ARCHER E. KNOWLTON

Oil in a transformer damps the higher frequency components more than it does the lower frequencies. Thus the oil alters the noise total and its tonal quality. Resonance may reaccentuate the harmonics.

Speed of relaying response suffers if very narrow-band crystals are used in an effort to permit closer spacing of carrier relay channels and better use of the carrier spectrum.

Vacuum tubes already number 1,500 in a large metropolitan power plant; 2,000 are contemplated; 700 alone regulate steam pressure and fuel-air proportioning.

Television indicates whether ignition torches in a boiler are lit; whether burner ignition takes place and continues; whether smoking may be developing and whether turbulence is functioning advantageously.

Mobile radio systems licensed to 1,187 electric utilities at end 1952 totaled 46,767 and fixed units 4,128; the petroleum pipeline industry correspondingly has 17,140 and 3,508.

Infra-red radiation impinging on lead sulfide changes its electrical resistance and thus makes a lead-sulfide film capable of fire detection.

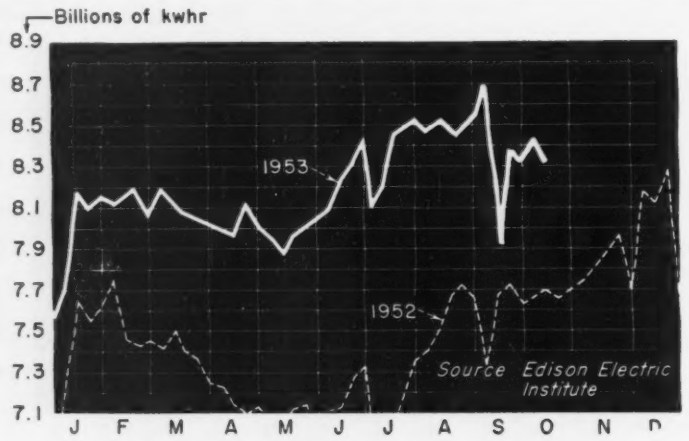
Amine forms of 2,4-D are preferable to use when there are sensitive crops nearby. Esters give better results on perennial weeds, older growths and brush.

Electrolytic means have been employed successfully to cut metal bars. The process is slow (⅝ inch in 24 hours). Ingenious design of the cathode assembly facilitates a smooth cut surface.

Meter cases and optical parts can be cleaned with solution that prevents further static adhesion of dust and dirt.

Herbicides of some types kill weeds effectively in substation yards but may corrode metal fittings and parts. Use with care around tower footings and buried ground wires.

STATISTICS



Output Week Ended Oct. 10—8,307,309,000 Kwhr

Per Cent Change From Previous Year

	Total US	New Eng.	Mid. Atlan.	Cent. Ind.	West Cent.	South-east	South Cent.	Rocky Mount.	Pacific NW	Pacific SW
Oct. 10	+7.9	+7.2	+4.0	+3.3	+5.3	+15.6	+8.5	+7.0	+22.0	+6.5
Oct. 3	+9.8	+5.7	+4.5	+4.3	+8.7	+20.1	+15.4	+7.5	+25.6	+3.8
Sept. 26	+9.6	+7.1	+3.8	+4.9	+7.6	+20.8	+9.0	+9.5	+23.5	+5.5

Electric Power Statistics

		Latest Month	Preceding Month	Year Ago
Peak Load (Million Kw)	July	76.6	76.0	67.2
Capacity (Million KW)	July	86.13	85.06	77.96
Production (Billion Kwhr)	Aug.	38.50	38.03	34.36
Hydro	Aug.	8.45	8.75	8.52
Fuel	Aug.	30.04	29.28	25.84
Fuel Consumption				
Coal (Million Tons)	Aug.	9.70	9.59	8.58
Oil (Million Barrels)	Aug.	6.55	6.35	5.37
Gas (Billion Cu Ft)	Aug.	112.88	109.35	105.40
Sales (Billion Kwhr)	July	32.13	31.77	27.70
Residential	July	8.47	8.37	7.50
Commercial	July	5.81	5.46	5.30
Industrial	July	15.50	15.80	12.64
Other	July	2.35	2.14	2.25
Net Income Class A & B Companies ($ Million)	Aug.	77.35*	74.11**	69.39
Estimated Dec. '53 Peak (Million Kw)	July	86.2	86.2	88.3
Kwhr per Residential Customer (12 Month Average)	July	2,273	2,257	2,104
Revenue per Kwhr Residential Service (12 Month Average)	July	2.76¢	2.76¢	2.78¢
Canadian Production (Billion Kwhr)	July	5.18	5.26	4.84

Business Statistics

FRB Industrial Production Index†††	Aug.	239*	234	218
Gross National Product Annual Rate ($ Billion)	2nd Qtr.	372.4	362.0	345.1
EW 5 Industry Production Index	Aug.	130.3	130.0	120.5
ENR Construction Cost Index††	Aug.	128.3	126.6	122.7
BLS Consumer's Price Index	Aug.	115.0	114.7	114.3
NEMA Insulation Materials Sales Index†	Aug.	153	150	128
NEMA Electric Appliance Sales Index†	Aug.	90	86	100
NEMA Household Refrig. Sales Index†	Aug.	63	87	75
Metal Prices (Oct. 13)				
Copper, Conn. V., lb		.29-.30	.29-.30	.24¼
Lead, N. Y., lb		.13½	.14	.14-.15
Zinc, prime Western E. St. Louis, lb		.10	.10	.13½
Tin, Straits, qual. N. Y., lb		.81	.81-.82	1.21½
Aluminum, ingot, base price		.21½	.21½	.20
Nickel, base price		.60	.60	.56½
Steel, billets, Pitts., ton		62.00	62.00	59.00
Steel, scrap, No. 1 heavy, Pitts., ton		36.00-38.00	41.00	46.00

*Preliminary **Revised †1947-49=100 ††1949=100 †††Unadjusted

Utility Plant Investment Versus Annual Revenue

The close correlation percentage-wise between electric utility plant investment by region, and revenue by region, has been demonstrated in the latest annual statistical report (on privately owned class A and B companies) published by the Federal Power Commission.

Electric Utility Plant—1952

Region	Amount	% of U.S. Total
New England	$ 1,681,305,533	7.3
Middle Atlantic	5,087,530,705	22.2
East North Central	5,650,346,062	24.6
West North Central	1,620,542,879	7.1
South Atlantic	2,925,160,211	12.7
East South Central	719,121,857	3.1
West South Central	1,837,215,078	8.0
Mountain	697,263,990	3.0
Pacific	2,748,463,839	12.0
United States	22,966,950,154	100.0

Of the 5.7 billion dollar revenue total, 98.8% represents sales of approximately 332 billion kwhr of energy to about 38,000 customers, while other revenues accounted for the remaining 1.2%. Total electric operating revenue deductions, including operation, maintenance, taxes, and depreciation and amortization, amounted to $4,558,835,549, or 80.5% of revenues.

Electric Utility Operating Revenues—1952

Region	Amount	% of U.S. Total
New England	$ 478,404,395	8.5
Middle Atlantic	1,373,362,913	24.3
East North Central	1,433,756,102	25.3
West North Central	409,378,751	7.2
South Atlantic	719,389,829	12.7
East South Central	175,955,651	3.1
West South Central	425,232,922	7.5
Mountain	153,109,757	2.7
Pacific	491,826,688	8.7
United States	5,660,417,008	100.0

Electric utility plant accounts for the end of 1952 represent almost 90% of the aggregate of utility plant accounts, which added up to $25,729,-339,905. For electric operations, the book investment in plant per dollar of annual revenue was $4.06.

The actual number of private A and B companies in operation dropped from 297 at the beginning of the year to 288 as of December 31, the change reflecting sales and mergers during the year.

Summary of Accelerated Amortization Dispositions for Electric Utility Industry

Number of States with Orders Issued	20
Number of States Without Orders But Asserting Jurisdiction	1
Number of Orders Prescribing Restricted or Appropriated Surplus Method of Accounting	22
Deferred Credit or Tax Reserve Method	7
Unclassified	1

State	Company	Date of Order	Accounting Disposition to Income	Accounting Disposition to Balance Sheet	Comments
Alabama	Alabama Power	7/24/52	Sub a/c of 507	Restricted Surplus	
Connecticut	Connecticut Light & Power	4/23/53	Sub a/c of 507	Tax Reserve	Stipulation that rate proceedings subsequent to close of five year period take into account tax equalization on books of company.
	United Illuminating	4/23/53	Sub a/c of 507	Tax Reserve	(Same as above)
Florida	Gulf Power	9/12/52	Sub a/c of 507	Restricted Surplus	
Georgia	Georgia Power	12/23/52	Sub a/c of 507	Tax Reserve	Tax reserve to be deducted from claimed rate bases in future rate proceedings.
Idaho	Washington Water Power	3/18/53	Sub a/c of 507	Restricted Surplus	Order specifically states that restricted surplus not available for dividends.
	Idaho Power	3/18/53	Sub a/c of 507	Tax Reserve	
Indiana	Indiana & Michigan Electric	10/7/52	Sub a/c of 507	Appropriated Surplus	Order states that this is for accounting purposes only.
Kentucky	Kentucky Utilities	11/25/52	Sub a/c of 507	Surplus Arising from Deferral of Taxes	This Surplus is a sub of the Capital Surplus — Account 270
Louisiana	General Order	2/25/53	Sub a/c of 507	Tax Reserve	Commission finds that normal taxes and normal depreciation is to be used for rate making purposes.
Maine	Central Maine Power	8/11/52	Sub a/c of 507	Restricted Surplus	
Michigan	Consumers Power	4/3/52	Sub a/c of 507	Appropriated Surplus	This is a sub-account of Appropriated or Capital Surplus Account 270.
	Detroit Edison	8/8/51	Sub a/c of 507	Tax Reserve	
	Indiana & Michigan Electric	10/17/52	Sub a/c of 507	Appropriated Surplus	
New Hampshire	Public Service Co of New Hampshire	5/20/52			Commission agreed with Michigan Commission and asserted jurisdiction in the event of the issuance of a certificate of necessity.

(To be continued)

General Accounting Office Is Investigating BPA

Bonneville Power Administration's financial operations and performance are being investigated by the General Accounting Office, the first study of its kind for the Pacific Northwest federal transmission agency.

While investigators are still far from finished, and at this date have no hint of when their comprehensive probe will be completed, the scope of the accounting and subsequent recommendations doubtlessly will be ready when Congress reconvenes.

GAO is answerable to Congress, not the executive branch.

While shunning comments on the BPA investigation, which was compared in scope wtih the recent audit of Southwestern Power Administration, a spokesman for GAO told a Washington correspondent for the "Portland Oregonian" that the audit of the Bureau of Reclamation was being wrapped up and promises to be highly argumentive if not directly critical of the USBR's activities in the past.

"That report is a real bearcat," the high official, who was not named, was quoted as telling the Portland, Ore., newspaper.

The auditing office took SPA to task for squabbling with the Corps of Engineers over allocations of power costs on multipurpose dams. This presumably may be a point in a similar investigation about to start into the affairs of the Southeastern Power Administration, although a spokesman declared it was premature to say what aspects of either Bonneville or Southeastern would receive special attention.

FINANCIAL BRIEFS

Columbus & Southern Ohio Electric Co is planning to sell its subsidiary, Columbus Transit Co. . . . **Imperial Irrigation District, El Centro, Calif.,** is contemplating selling $10 million of bonds to finance the 33,000-kw Pilot Knob project.

Private Placements—Indiana & Michigan Electric Co has sold 60,000 shares of 4.56% cumulative $100 par preferred stock to 15 institutions. . . . **Oklahoma Gas & Electric Co** has sold 50,000 shares of $100 par 4.85% preferred stock to seven institutions.

Today in Utility Finance

YIELDS (%)

Quality	Bonds			Preferred Stock			Common Stock		
	1st	2nd	3rd	1st	2nd	3rd	1st	2nd	3rd
DATE									
1953									
Oct. 8	**3.22**	**3.25**	**3.44**	**4.26**	**4.43**	**4.75**	**5.26**	**5.78**	**5.86**
Oct. 1	3.26	3.30	3.51	4.30	4.48	4.79	5.31	5.86	5.91
END OF QTR									
3rd 1953	3.30	3.33	3.54	4.35	4.52	4.83	5.36	5.97	6.01
2nd 1953	3.34	3.46	3.64	4.47	4.70	4.88	5.52	5.93	6.10
1st 1952	3.15	3.23	3.39	4.16	4.41	4.66	4.95	5.24	5.50
4th 1952	2.99	3.03	3.14	4.06	4.22	4.59	4.98	5.33	5.62

Data: Reis & Chandler, Inc.

EARNINGS

Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
El Paso Electric	12	Aug.	$1,644,844	$1,501,806	$2.06	$1.88
Gatineau Power	6	June	2,000,777	1,856,009	....	....
Iowa Electric Light & Power	12	Aug.	2,784,457	2,441,445	1.85	1.59
Jacksonville, Fla., municipal electric system	8	Aug.	4,825,842(a)	4,217,606(a)	....	....
Pacific Power & Light	12	Aug.	4,568,269	4,210,255	....	....
Southern Canada Power	11	Aug.	1,317,832	1,089,949	....	....
Tampa Electric	12	Aug.	2,603,789	2,010,382	3.63	2.98
West Penn Electric, consolidated	12	Aug.	13,778,901	12,219,627	3.26(b)	3.08(b)

Notes—(a) Net revenue; and (b) Based on 4,224,000 shares in 1953 and 3,960,000 shares in 1952.

FINANCING

Company and Description	Amount of Offering (000)	Offering Price	Yield to Public
WEEK OF OCTOBER 8-14			
Bonds			
Kansas Gas & Electric—1st mtg 3⅝% due 1983	$10,000	102.125%	3.51%
Rockland L&P—1st mtg 3¾% due 1983	8,000	102.738	3.60
Los Angeles Department of W&P—revenue bonds 5, 2, 2¼, 2½, 2¾%	$20,000	various	1.40-2.80
Common Stock			
Rockland L&P—210,721 sh (being offered on a 1-for-7 basis, record Oct. 7 to expire Oct. 21, with an oversubscription privilege)	$2,149	$10.20	5.88%
Florida Power Corp—211,416 sh (being offered on 1-for-10 basis to commonholders of record Oct. 8 to expire Oct. 26)	5,074	24.00	6.25
Hawaiian Electric—100,000 sh (being offered on a 1-for-5½ basis, record Oct. 5)	2,000	20.00	10.00
Long Island Lighting—685,648 sh (to be offered commonholders on 1-for-7 basis, record Oct. 14 to expire Oct. 29) (b)	10,970	16.00	6.25
SCHEDULE FOR OCTOBER—NOVEMBER—DECEMBER			
Bonds			**Bid Date**
Public Service Electric & Gas—1st mtg due 1983	30,000	.....	Oct. 27
Niagara Mohawk Power—gen mtg due 1983	40,000	.....	Oct. 28
Gulf States Utilities—1st mtg	10,000	.....	Nov. 23
Monongahela Power—1st mtg due 1983	10,000	.....	Dec. 1
Preferred Stock			
Worcester County Electric—75,000 sh $100 par	$7,500	.....	Nov. 17
Duquesne Light—100,000 sh $50 par	5,000	.....	.....
Kansas Gas & Electric—50,000 sh $100 par	5,000(a)	.....	.....
Common Stock			
Public Service E&G—800,000 sh (c)	.....	.....	Oct. 20
Hartford Electric Light—105,500 sh (to be offered commonholders on a 1-for-8 basis, record Oct. 23 to expire Nov. 10)	.....	.....	.....
Central Illinois Light—100,000 sh (to be offered commonholders on a 1-for-9 basis, record Oct. 27 to expire Nov. 13 with an oversubscription privilege)	.....	.....	.....
Delaware Power & Light—232,520 sh (to be offered commonholders on a 1-for-7 basis, record Nov. 25)	.....	.....	.....
Virginia Electric Power—558,946 sh	.....	.....	.....
POSTPONED, UNSCHEDULED, AND/OR UNDER CONSIDERATION			
Bonds			
Long Island Lighting—1st mtg	$25,000(e)	.....	.....
Southwestern Public Service—1st mtg	12,000(e)	.....	.....
Illinois Power Co—1st mtg	20,000	.....	.....
Essex County Electric—1st mtg due 1983	4,000	.....	.....
Florida Power Corp—1st mtg	10,000(e)	.....	.....
Houston Lighting & Power—1st mtg	25,000	.....	.....
Preferred Stock			
Southwestern Public Service	$3,000(e)	.....	.....
Narragansett Electric	7,500	.....	.....
Common Stock			
Iowa-Illinois Electric & Gas	$6,000(f)	.....	.....
Southwestern Public Service—(to be offered on about a 1-for-13 basis)	.....	.....	.....

Notes—(a) Company gets FPC permission to sell the stock privately; (b) Plus 100,000 shares to be offered employees; (c) To be sold privately; (e) Estimated; and (f) To sell enough common stock to yield $6 million.

TWO 100,000-KW G-E REHEAT TURBINES—tandem-compound, double-flow—at the Lee Steam plant of the Duke Power Company, near Greenville, S. C. This plant was designed and constructed by the Company's Engineering and Construction Departments.

G-E tandem-compound, double-flow design spurs trend to reheat turbines

First modern reheat turbine developed after World War II, the tandem-compound, double-flow design has been hailed as one of the most significant of recent G-E contributions to turbine progress.

Making available the increased efficiency of reheat in size ranges from 50,000 to 150,000 kw, the design has won enthusiastic acceptance throughout the electric utility industry.

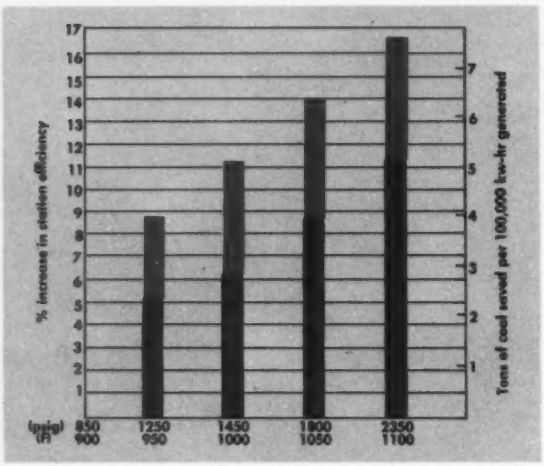
The first such unit was installed at the Dunkirk Station of the Niagara-Mohawk Power Corporation. The remarkable record of this turbine, and the widespread adoption of the design for machines in many other installations throughout the country, has been an important factor in today's overwhelming trend to the reheat cycle.

A typically successful performance has been turned in by the two 100,000 kw units at the Lee Steam plant of the Duke Power Company pictured above. The next three pages show you why. *General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

FOR DETAILS, TURN TO NEXT THREE PAGES . . .

Outstanding design advantages yield cut down cost of both installation


% increase in station efficiency
Tons of coal saved per 100,000 kw-hr generated
(psig) 850 1250 1450 1800 2350
(F) 900 950 1000 1050 1100

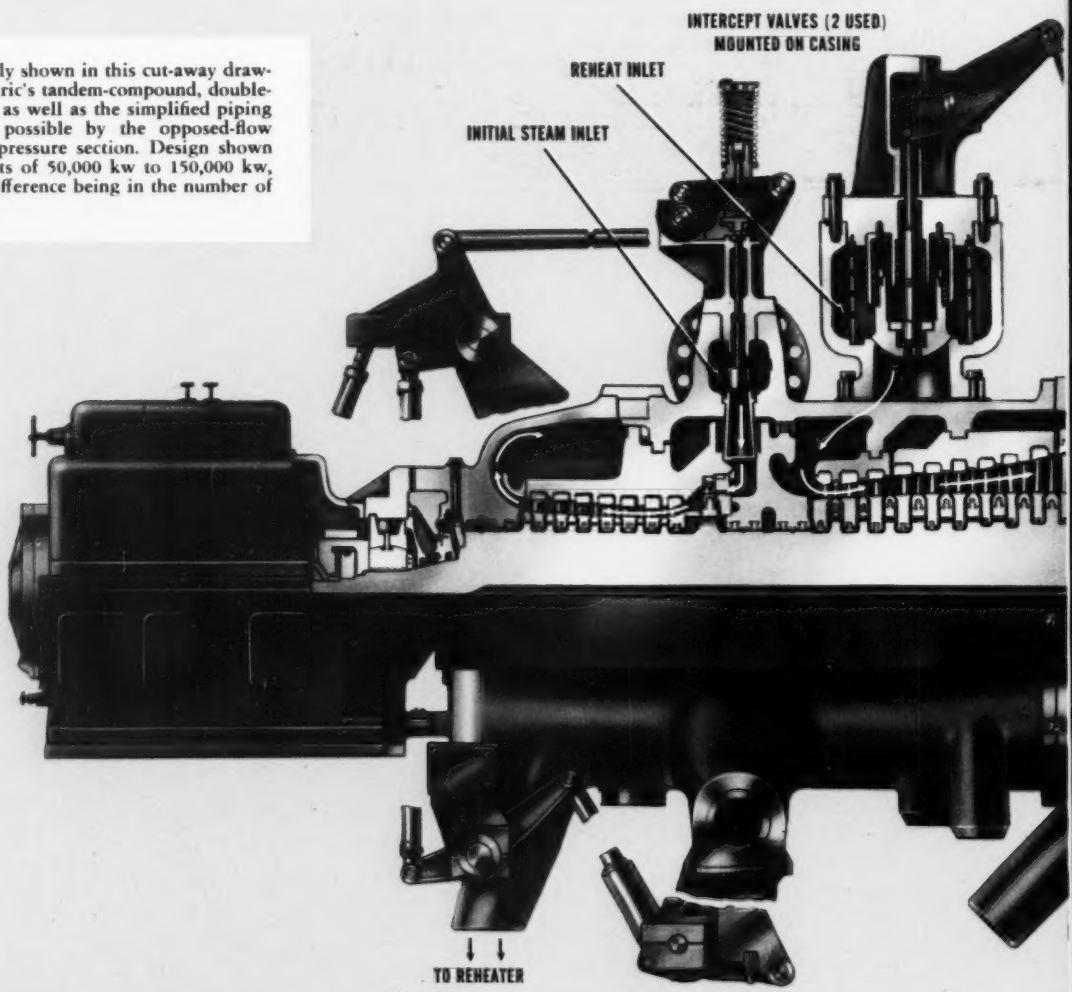
Gains in efficiency and corresponding fuel savings through the use of the reheat cycle at typical temperatures and pressures are shown in red on the chart above. Efficiency gain in each case is about five per cent.

Developed to take advantage of the approximate five per cent gain in thermal efficiency obtainable with the reheat cycle, while retaining the essential compactness of a non-reheat unit, the tandem-compound, double-flow design represents a significant achievement of G-E engineering.

Opposed flow design of the high pressure section offers a simple, practical solution to many of the problems of reheat design. By admitting both the initial and reheat steam near the center of the high-pressure casing, high steam temperatures are concentrated in a relatively small portion of the casings. Severe temperature gradients with resulting thermal distortion are avoided, and heat flow into the seals and bearings is reduced. This design feature also reduces the load on the thrust bearing.

Including the high pressure and reheat stages on a single shaft span contributes to minimum space requirements and maximum simplicity. The short shaft length reduces foundation expense. Foundation and space requirements for this

Steam flow is clearly shown in this cut-away drawing of General Electric's tandem-compound, double-flow reheat turbine, as well as the simplified piping and control made possible by the opposed-flow design of the high-pressure section. Design shown is applicable to units of 50,000 kw to 150,000 kw, the only essential difference being in the number of stages and size.



new highs in station efficiencies; and maintenance

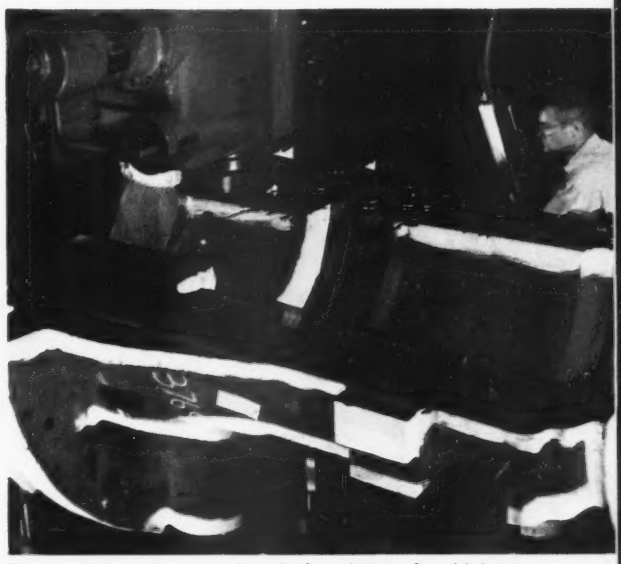
type of unit are essentially the same as for a similarly rated non-reheat unit — an important factor in installation costs.

Contributing to the low maintenance cost of these machines is an advantage inherent in reheat turbines — the reduction of bucket erosion because of reduced moisture at the low-pressure end.

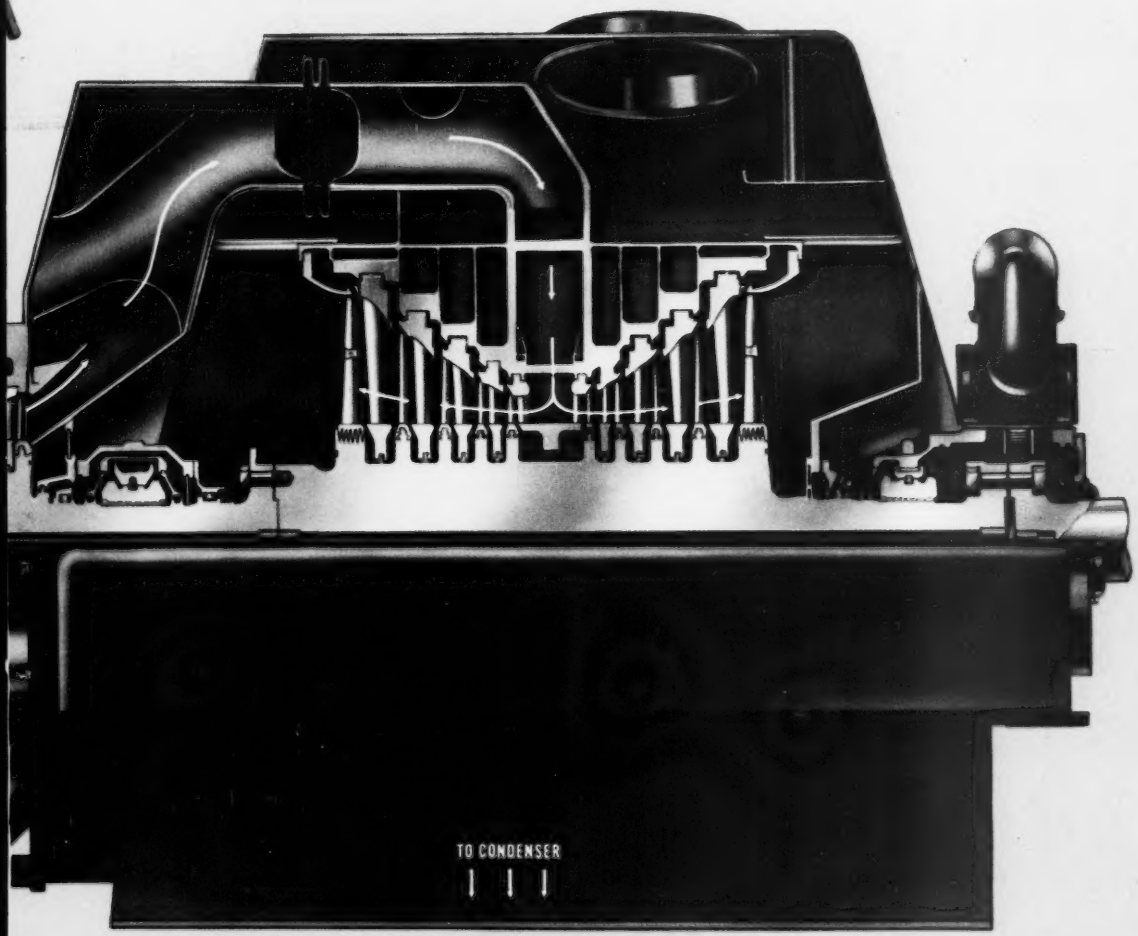
More than thirty of these units have been placed in service, and another fifty are on order, being manufactured, or awaiting installation. The combination of high efficiency with low installation cost and pronounced savings in maintenance expense assures continued popularity of these units throughout an increasingly cost-conscious industry.

Leader in Turbine-Generator Progress

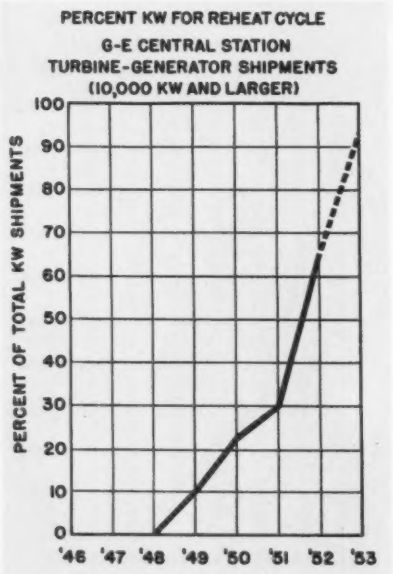
GENERAL ELECTRIC



Even greater accuracy in planing joints for high-pressure shells and reduced machining time are now being achieved with this new planer miller machine, recently installed. General Electric turbines have an outstanding record for steam-tight shells.



"Fuel economics, steady design progress accelerate the swing to reheat cycle"



. . . Says William E. Saupe, General Manager, Large Steam Turbine and Generator Department, General Electric Company.

"The rapid growth in popularity of the reheat cycle, particularly in the 50,000 kw and above sizes, has been, in our opinion, the biggest recent factor in the improvement of fuel economy through coordinated station design progress. Much of this trend has stemmed from our tandem-compound, double-flow design which has gained widespread industry acceptance.

"We knew, just after the war, that fuel costs would move up. Reheat, basically an old idea, was the logical way to save fuel inasmuch as metallurgical limitations prevented any equivalent progress in non-reheat turbine efficiencies. We teamed up with boiler manufacturers and customers to work out an average heat consumption reduction of five per cent.

"The trend to reheat isn't confined to high fuel cost areas alone. Interest is steadily growing everywhere because reheat turbines have longer life. They need less maintenance; they save condensing water. These advantages, plus improved economy, usually justify the additional cost premium required.

"Our estimates of the growth of America's power generating capacity during the next ten years indicate a higher percentage of steam turbines. Most of these turbines will be reheat." 254-13

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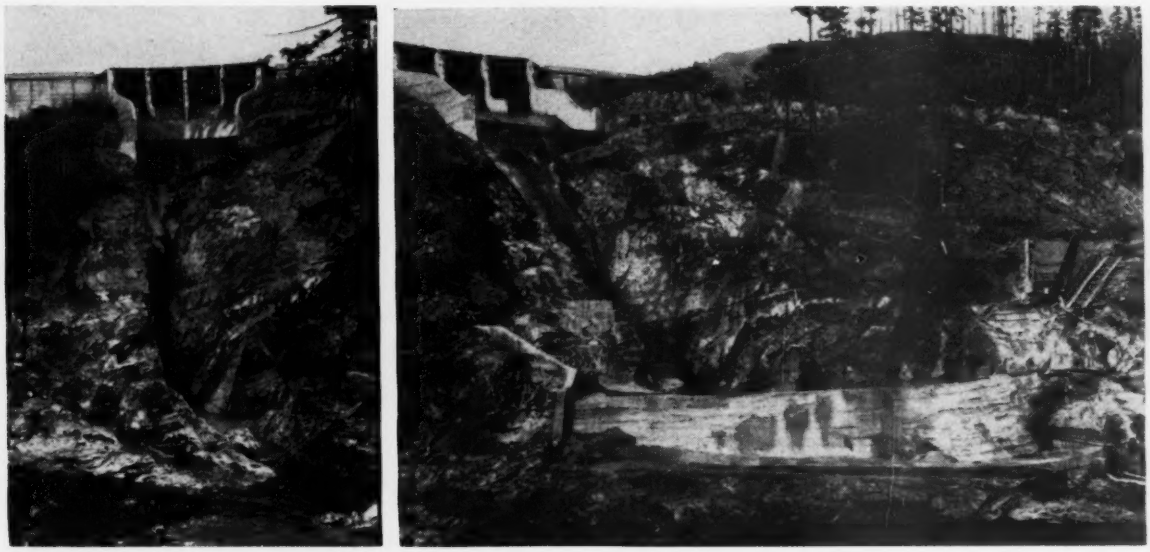


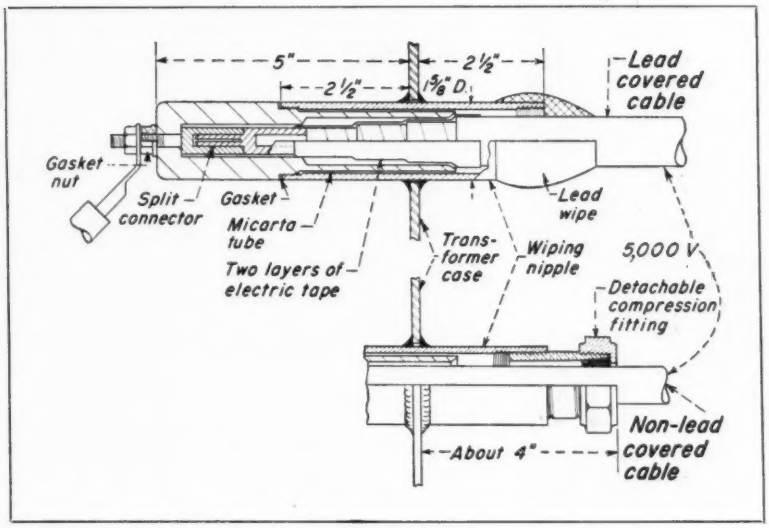
Eroding Spillway Saved by Concrete and Skip-Dam

Eroded fault zone in spillway channel at Tacoma City Light's Alder Dam was caused by forced spilling of water in excess of original plans. Extensive spilling also created a stilling pool measuring about 150 ft long, 100 ft wide and 80 ft deep at base of spillway.

Spillway repair consisted of diamond-drilling and cement-grouting river side of stilling pool and adding skip-dam to restore height of pool rim. Then pool and mouth of fault were unwatered. Reinforced concrete was placed in fault zone up to lower end of spillway.

Utility Adopts Permanently Sealed Subway Transformers

JOHN R. KELLEY, Engineer of Underground Distribution, Los Angeles Dept of Water and Power, Los Angeles, Calif.



PRIMARY CABLE ENTRANCE for permanently sealed transformer is shown for leaded and non-leaded 5-kv cable. Threaded stud on low side permits use of solderless connectors

Installation and operation of subway transformers in ratings up to 167.5 kva under permanently sealed conditions are now the practice of Los Angeles Dept of Water and Power.

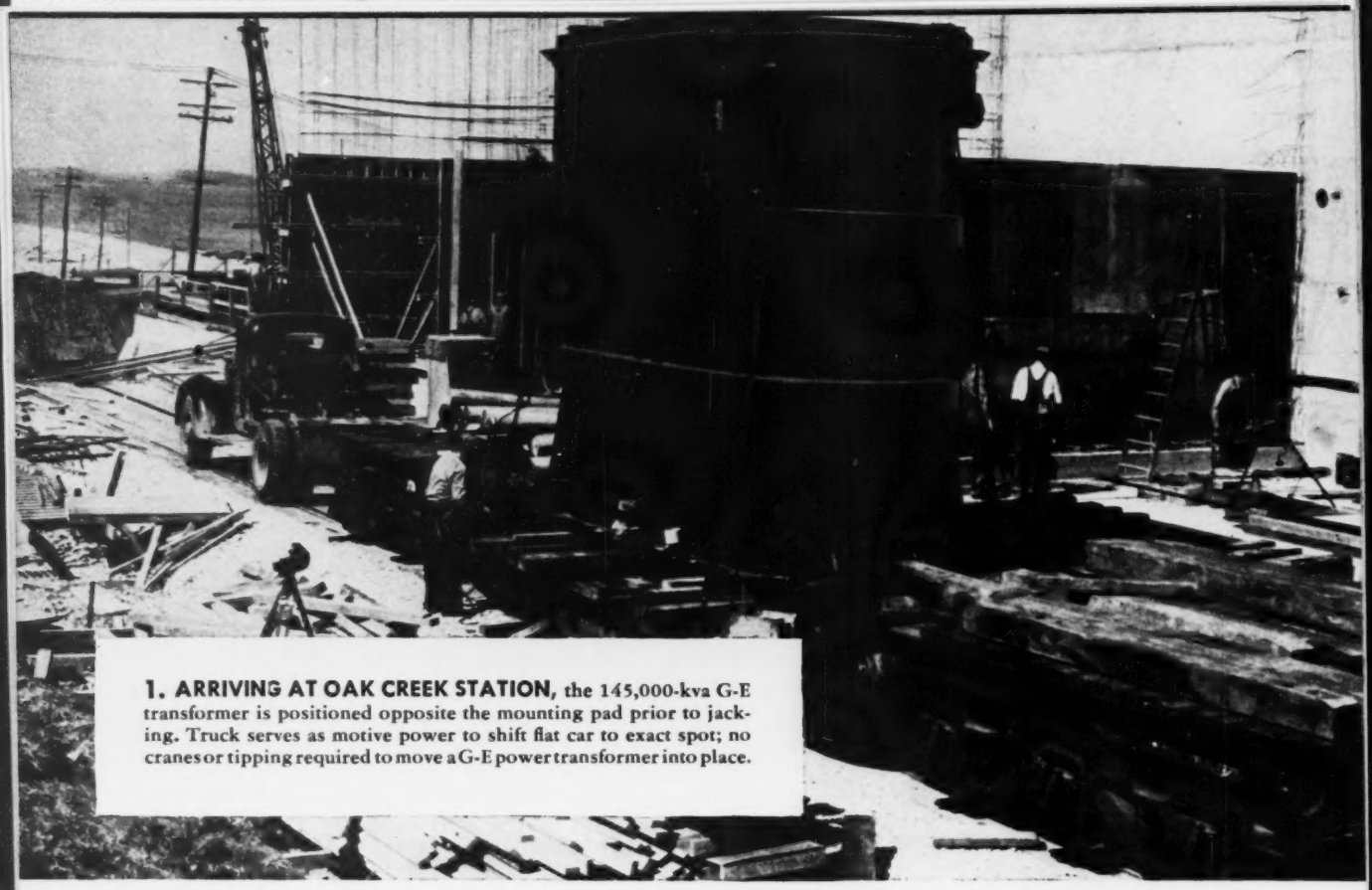
Transformers now received are tested and placed in service without breaking the factory seal.

Modifications of primary and secondary terminals of standard NEMA-EEI subway transformers make this procedure possible. On the high side, a bayonet-type connector has been designed that maintains the seal between tank and cable.

It incorporates an insulating guide tube that is closed at the base with gasket and nut for the bayonet on one side and has a stud for connecting the transformer lead on the other side.

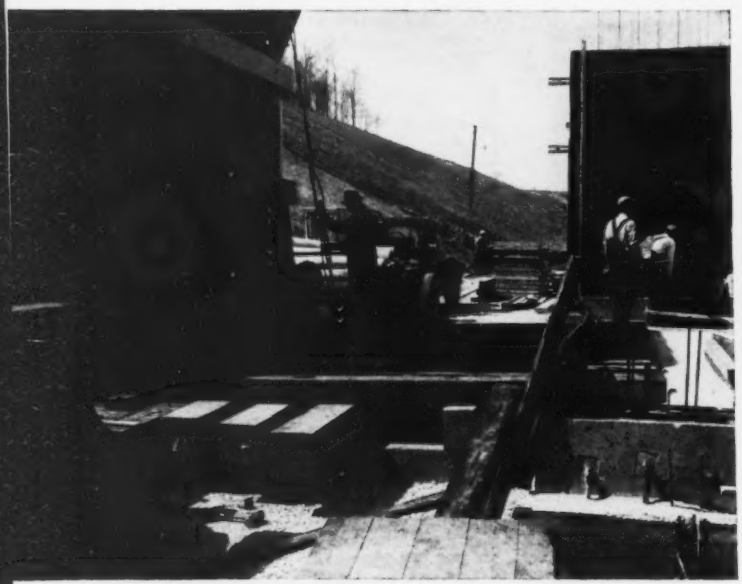
Guide tube is attached to and permanently sealed at the inside end of

(*Continued on page* 142)

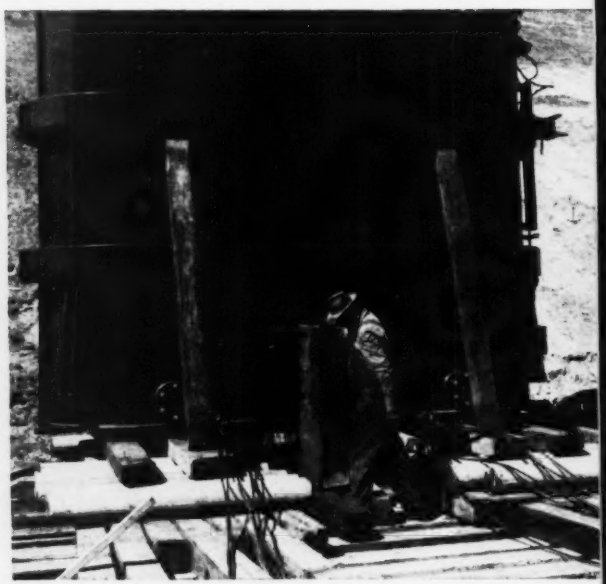


1. ARRIVING AT OAK CREEK STATION, the 145,000-kva G-E transformer is positioned opposite the mounting pad prior to jacking. Truck serves as motive power to shift flat car to exact spot; no cranes or tipping required to move a G-E power transformer into place.

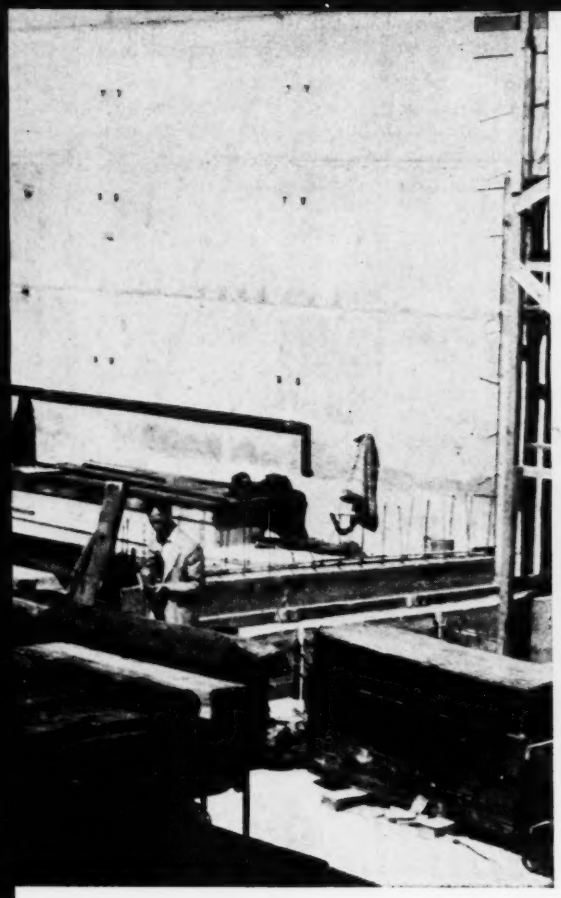
UPRIGHT SHIPMENT SPEEDS

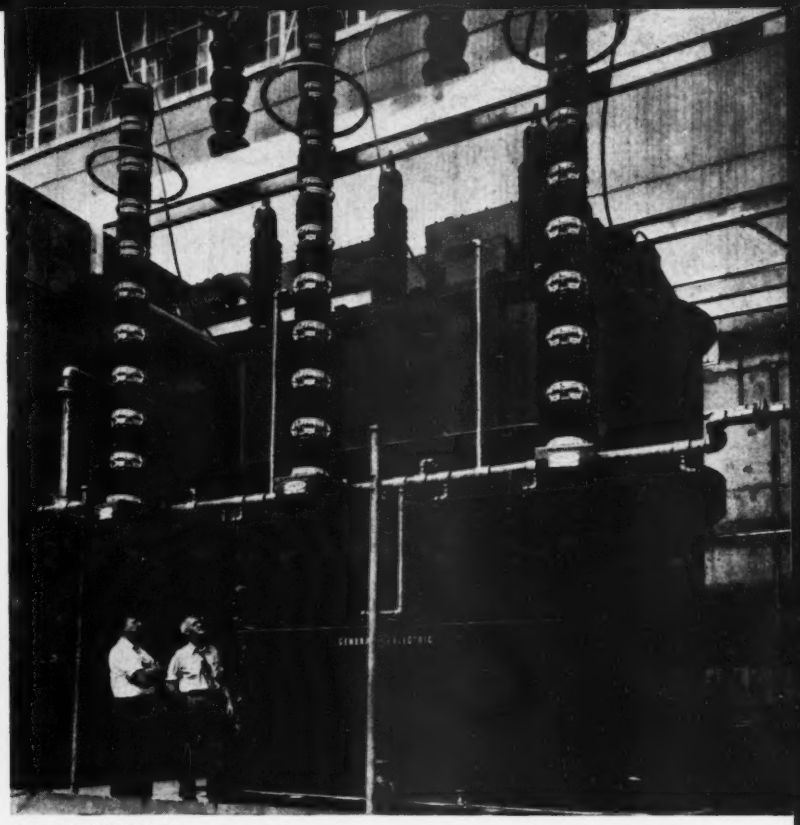


2. AFTER JACKING the unit is ready to be moved to the pad. Next step is to put wooden rollers in place. Total time required for jacking and positioning skids and rollers was 2½ days. Only truck winches were needed.



3. BLOCKS ATTACHED and ready to start rolling. Workman checks position of rollers before starting the shift from flat car to pad. While nearness of siding to pad helped reduce time, upright shipment simplifies any installation.





4. UNIT IN PLACE with bushings, cooler connections, and arresters installed. Only 4 operations were necessary to complete the installation of this 145,000-kva G-E transformer. Upright shipment makes the job easier!

G-E TRANSFORMER INSTALLATION

145,000-kva units for WEPCO shipped upright in one-piece tanks for easier, faster installation—at less cost

One of two General Electric 145,000-kva forced-oil water-cooled power transformers is shown being installed at the new Oak Creek station of Wisconsin Electric Power Company. These units are step-up transformers applied to raise generator voltage from 13,200 volts to 138,000 Gr Y for high-voltage transmission.

Installation was faster due to G-E one-piece tank construction and upright shipment. Installation time ran as follows: Jacking, 2½ days; moving to pad, ½ day; installing bushings, 1 day; filling with oil, 6 hours.

Only 4 operations are required to install large G-E power transformers:

1—Slide off flat car onto pad—no tipping, no top tank-sections to assemble.

2—Install bushings, radiators, and accessories.

3—Fill with oil and connect oil preservation equipment.

4—Connect to line and energize.

Upright shipment saves time, money. Instead of arriving on its side, or in sections—which would require expensive tipping and assembly operations—most G-E transformers arrive upright . . . ready to slide off the flat car to the foundation. This means that G-E transformers can be installed faster and easier. Utilities report that upright shipment has saved them up to $1750 per unit in installation costs.

Why can G-E units be shipped upright? All G-E transformers have concentric windings. These windings have higher thermal, mechanical and electrical strength, yet are very compact. They permit transformers to be fitted into smaller tanks which can be shipped in the upright position.

For full information about G-E power transformers, get in touch with your nearest G-E Apparatus Sales Office. General Electric Company, Schenectady 5, N. Y.

421-12

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Subway Transformers

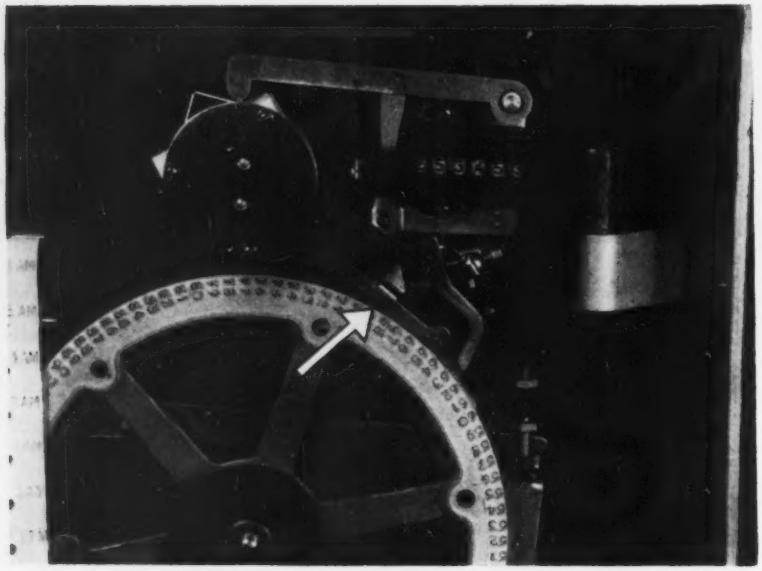
(*Continued from page* 139)

the wiping nipple with threaded connection and gasket.

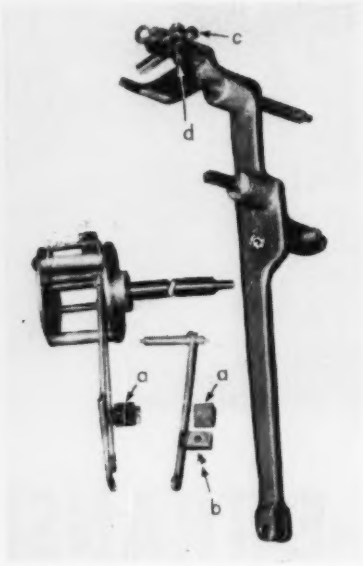
For use with synthetic-rubber insulated primary cables, wiping nipples measure 1⅝ in. in diameter and 5¼ in. long. They are threaded inside to allow a packing gland type of fitting to be attached. On the low side, a threaded stud is provided in place of the conventional spade to permit use of solderless connectors.

Transformers are shipped under low nitrogen pressure and a gage is provided for testing tank pressure without breaking the permanent seal. Transformers purchased by the Department represent a specific example of broad modifications recommended by California Inter-Utilities Underground Standards Committee for development of a permanently sealed subway-type transformer.

Modifications from standard were as follows: Temperature rise—40 C, sealing—completely welded—no gasketed covers or handholes, cable entrances—bayonet type with wiping nipples, secondary bushings—stud type terminals with solderless connectors, nitrogen gas—applied prior to shipment under positive pressure. In other respects, NEMA Pub. 113-1951 remained applicable.



DEMAND-PRINTING METER has long pawl lifted to reveal short-pawl stop block and pawl-adjusting screws. Stop prevents rachet-wheel overshooting



MODIFICATION of meter includes a diagonal block (a) fastened to the short pawl

Stop Prevents Over Registration of Demand-Printing Meter

M. R. YARGER, Meterman, Standardizing Laboratory, Ohio Power Co, Canton, Ohio

An adjustable stop for a short pawl, similar to a stop for a long pawl, prevents ratchet-wheel overshooting on printing type demand meters. This simple modification was an expedient adapted for handling clearance trouble between ratchet-wheel teeth and relaxed pawls on some existing meters.

After this modification, the meter's walking beam is adjusted to give a clearance between the ratchet teeth and relaxed pawl points of approximately 0.01 in., for both long and short pawls. Then the walking beam is operated manually to give a complete revolution of the ratchet wheel, while checking each tooth to be sure that both pawls engage properly. If not, the walking beam is adjusted slightly to allow proper engagement of pawls.

The stop screw for the short pawl is adjusted in the same manner as for the long pawl. Both pawl points must be set as close to ratchet wheel as possible without interfering with free travel of pawls during either advancing or resetting movement.

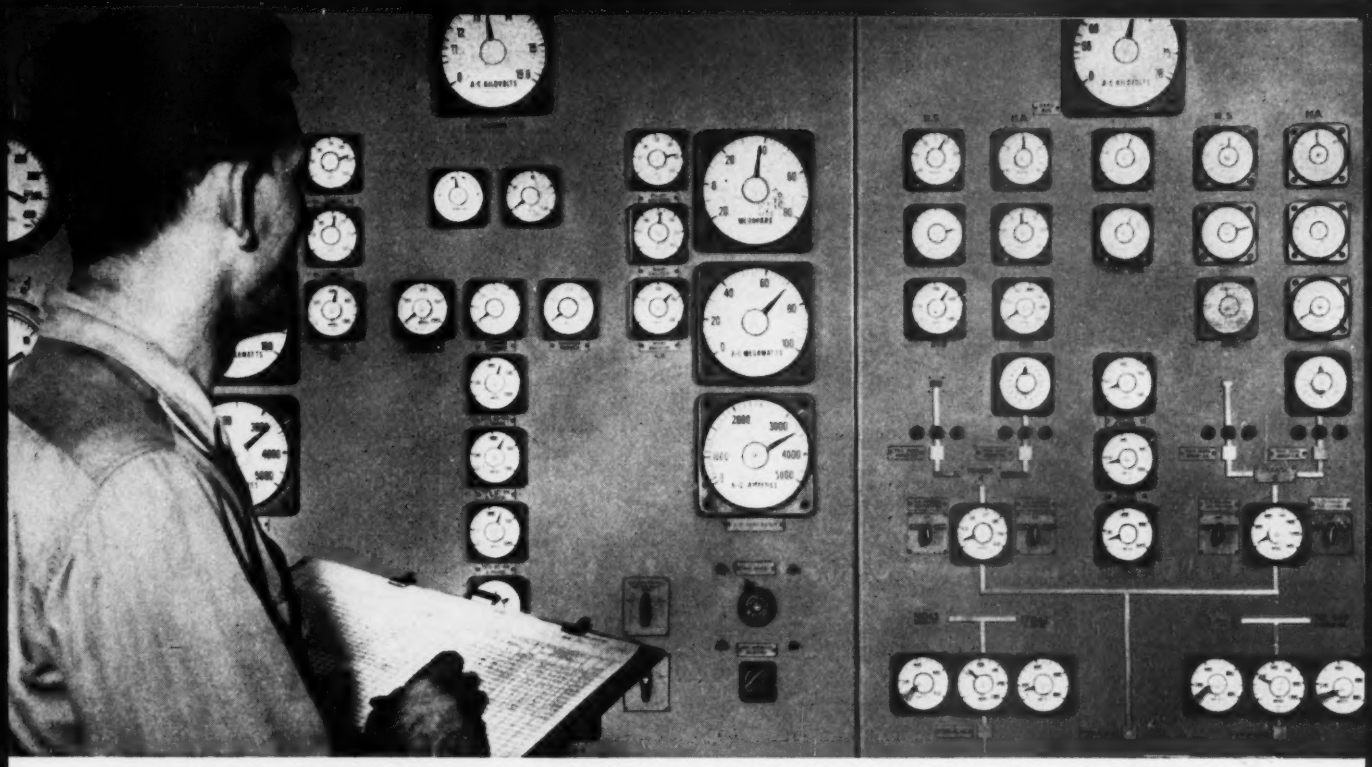
Pawl modifications that were required, including illustration references, are as follows. For stop blocks, a ⅛ in. square piece of stock was cut diagonally and then into ¼ in. lengths.

One of the resulting blocks (a) was fastened to the back projection of the short pawl with the sloping face away from the pawl suspension. For this purpose a 2/64 flat-head screw ⅛ in. long (b) was used.

For additional assurance against loosening, the block was soldered to the projection.

For adjusting the short pawl stop, the release lever was drilled and tapped for 8/32 screw 1 in. long (c) approximately ⅛ in. from centerline of long pawl adjusting screw. To lock the short-pawl adjusting screw, a hole was drilled and tapped for a 6/32 headless screw ⅛ in. long (d) on the underside of release lever.

With the additional adjustable stop, the demand-printing meters have been found reliable, even when operating coils are energized at considerable overvoltage.



G-E SHADOW-PROOF INSTRUMENTS OFFER SMALL SIZE FOR ECONOMY OF SPACE AND A LONG SCALE FOR EASY READING.

Modernize with G-E Small-size Instruments And Save up to 33% of Switchboard Space

General Electric switchboard instruments can help you to economize in your plans for plant modernization or expansion by allowing more efficient use of switchboard space.

SPACE-SAVING DESIGN of G-E switchboard instruments makes it possible for you to save as much as 33⅓% of valuable switchboard space. A long-scale face only 4¼ inches across is attained because the instrument is designed to operate throughout a 250° arc.

SUSTAINED ACCURACY—±1% of full scale—is assured by building these long-scale instruments around a one-piece magnetic circuit. Since the circuit is thus made a solid mass, the air gap can never vary. Flux always flows evenly to give you accurate readings time after time.

FOR MORE INFORMATION, contact your G-E Apparatus Sales representative, or write for bulletin GEC-218 to Section 602-268, General Electric, Schenectady 5, N. Y.

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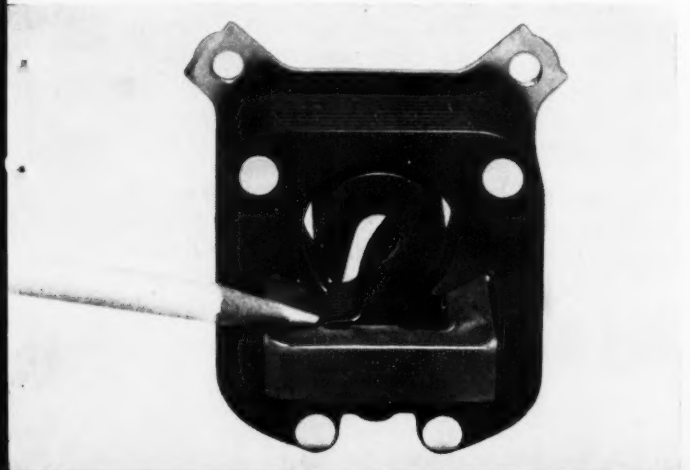
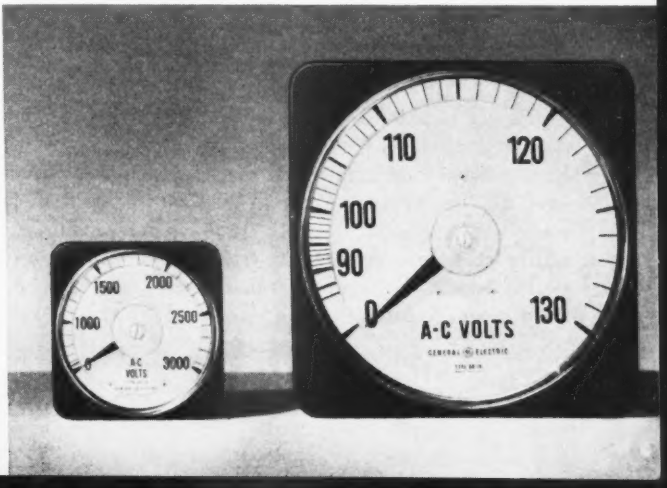
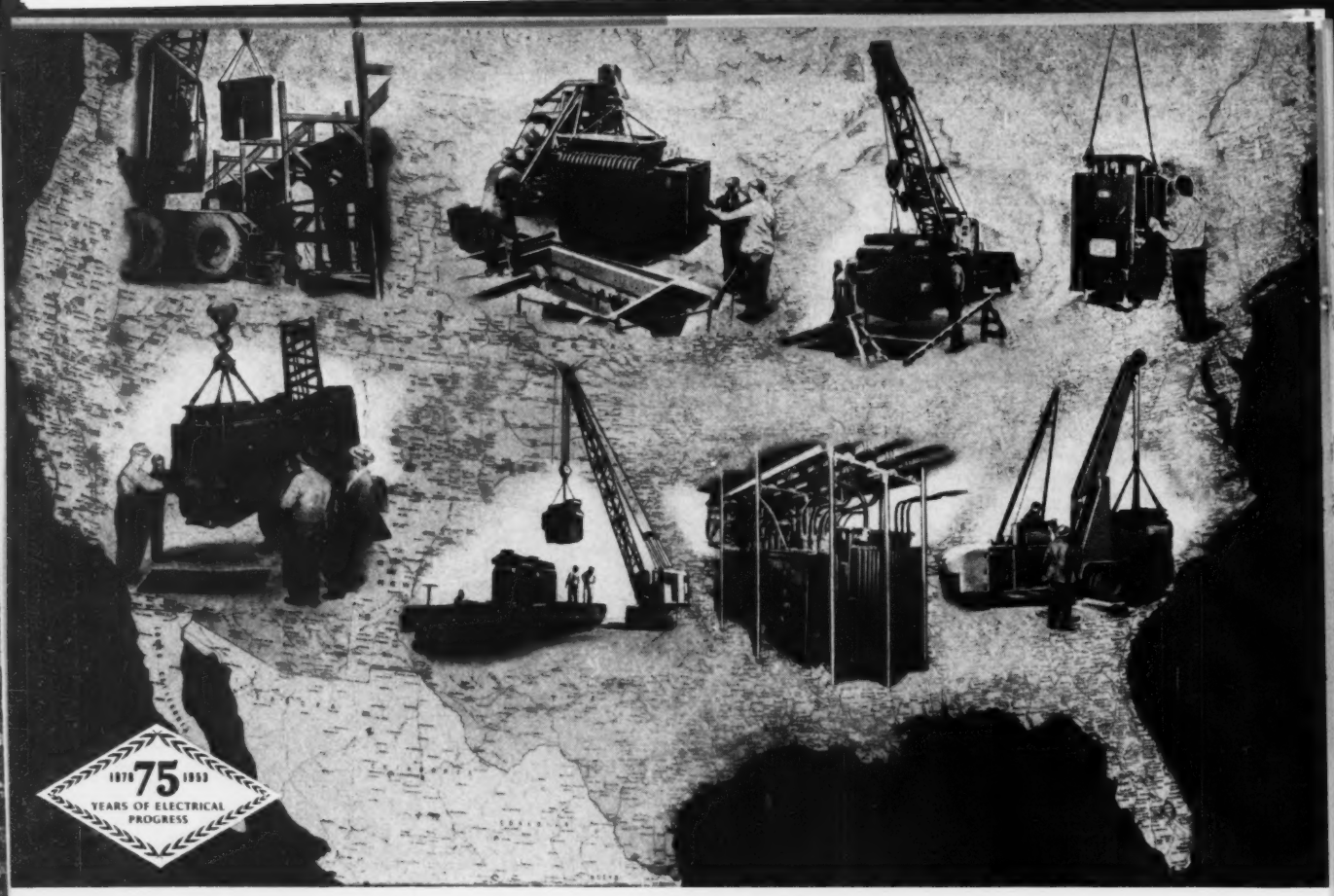
ONE-PIECE CONSTRUCTION of the G-E magnetic circuit provides a permanent air gap. Flux density, therefore, always remains uniform—making for readings which are consistently accurate.



TWO SIZES AVAILABLE—including both 4¼-inch and 8¾-inch instruments. The large size instrument is designed for those applications where readings must be taken at extra long distances.





Secondary networks key to easy expansion in city after city across the nation

G-E network units added by many utilities . . . often as only step in increasing system capacity

Even today's rapidly expanding urban loads cause little difficulty in cities where secondary network systems have been installed.

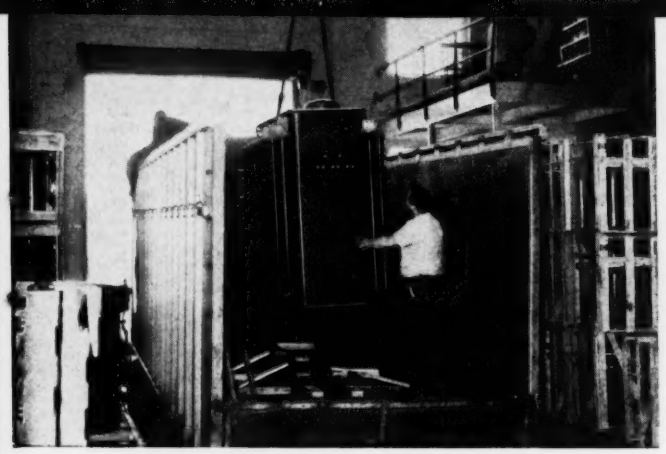
Unlike radial distribution systems, secondary networks permit electric utilities to handle increased loads—foreseen and unforeseen—without resorting to extensive engineering calculations, rearrangement or bolstering of circuits, or juggling of existing loads. And this, in addition to maintaining virtually uninterrupted service and uniformly firm voltage!

The installations pictured on the right clearly demonstrate the ease of meeting load growth once you have gone to a secondary network. In practically every case, all that was necessary to take care of increased loads was additional network units. Where required, utility crewmen constructed transformer vaults; installed new G-E network transformers; and tapped them in to reinforce existing secondary grids!

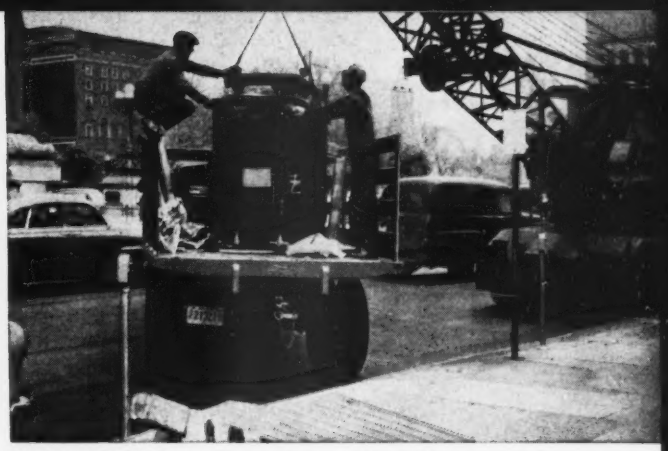
If you're struggling to accommodate new loads by perpetuating a radial system and your load density has risen to approximately 10,000 to 15,000 kva per square mile, it may be time for you to investigate the flexibility and economy of a secondary network.

When you do, be sure to consider the extra advantages of G-E standardized network equipment. Quantity production methods reduce manufacturing and assembly time. You get faster delivery at lower prices. And refinement in design—made possible by quantity production—means lower installation and maintenance costs.

For help in solving your network problems and for complete information on G-E network transformers, see your local G-E representative. Or write for Bulletin GEA-5024. *General Electric Company, Schenectady 5, New York.*



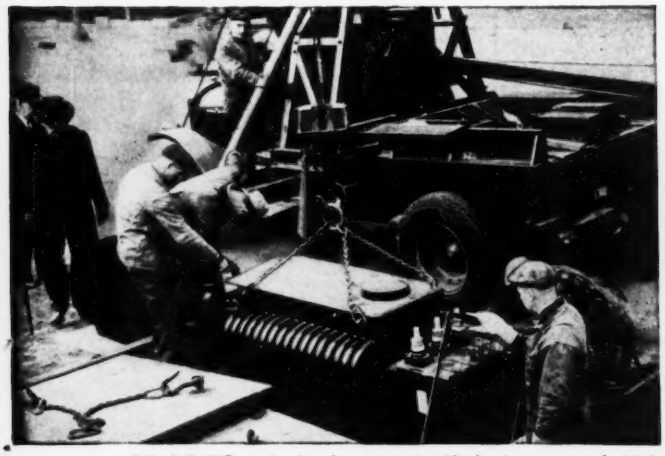
PROVIDENCE Narragansett Electric Company prepares to add another G-E network unit. An overhead crane eases unit into truck for transportation to vault site.



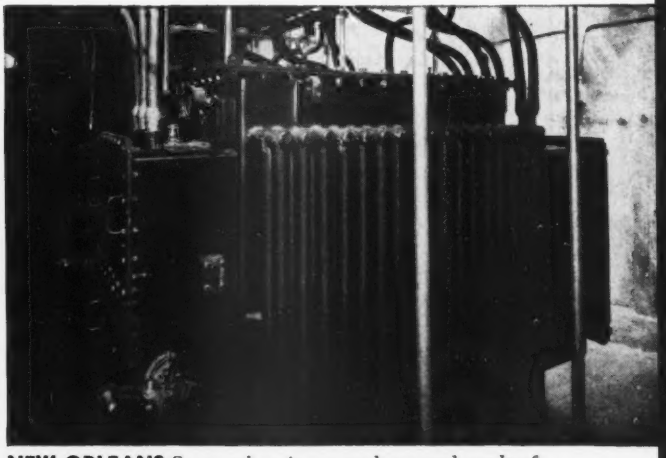
INDIANAPOLIS Crewmen of the Indianapolis Power & Light Company rig a new G-E network transformer to be transferred to sidewalk vault on North Pennsylvania Street.

SACRAMENTO And still another General Electric network transformer being added. Workmen are guiding suspended unit towards vault opening.

SAN FRANCISCO adds capacity in heart of "down town" district. G-E standardized network unit enabled Pacific Gas & Electric to construct vault of minimum size at Pine St.



ST. LOUIS and the location is Clark Avenue and 15th Street. Union Electric's crew will soon have this standard G-E network unit in place and connected to secondary grid.



NEW ORLEANS Scene taken in an underground vault of the New Orleans Public Service system shows G-E network units connected up and ready to handle their share of load.

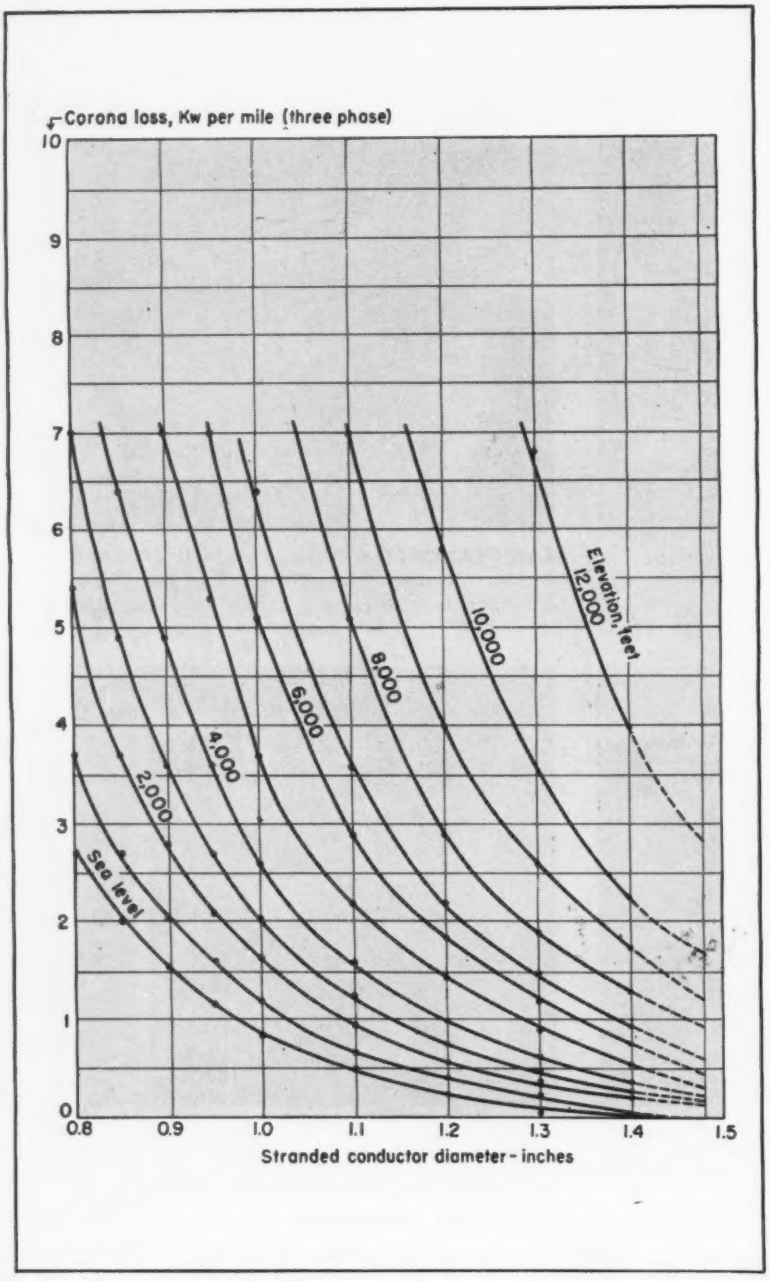
GENERAL ELECTRIC

402-119

Corona Loss Curves for 230 Kv Lines

To expedite choice of line conductors, corona loss curves covering a range of conductors for 12 elevations are presented. Curves are based upon the empirical method of Carroll and Rockwell

M. H. COHN, Transmission Line Design Unit, Bureau of Reclamation, Denver, Colo.



Size cir mil	Diameter, Inches
397,500 *	0.783
477,000 *	0.858
636,000 *	0.990
795,000 *	1.108
954,000 **	1.196
1,113,000 †	1.293
1,272,000 †	1.382
1,431,000 †	1.465
1,590,000 †	1.545

* 26/7 stranding
** 54/7 stranding
† 54/19

Specifications:

Weather: 77 F
Conductor Spacing
Flat
22 ft

Note: This concludes a series of three reference sheets. Previous sheets presented corona loss curves for 69 kv, 115 kv, 138 kv and 161 kv (EW, Sept. 27 and Oct. 5, 1953).

Blast the Arc WITH DELTA-STAR'S NEW "JT-1"

Gas Blast Interrupting Device

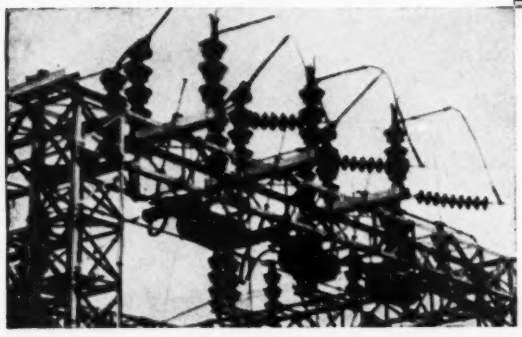
Delta-Star's new "JT-1" interrupting device for use with standard air switches is now ready for installation on your transmission systems. Extensive laboratory and field tests including many actual installations have proved the "JT-1" to be the ideal device for use on transmission lines from 69 to 161 kv where circumstances do not require the interrupting capacity or justify the use of a circuit breaker. With the "JT-1" installed on your air switches light loads can be interrupted without danger of long arcs causing phase-to-phase faults.

The "JT-1" is a gas blast device utilizing compressed nitrogen or air to "blow out" the arc at the contacts of a switch immediately after the arc has formed. The gas blast is controlled by a cam operated valve mechanism under each switch unit which is in turn operated directly by the switch operating mechanism. These valves open automatically when the switch blade reaches a predetermined position.

Since arc extinction does not depend on gas expulsion by disintegration of an arc chamber an unlimited number of operations are possible without replacement of parts.

The next time you have a problem where switches must be operated under load or long lines dropped, investigate the possibility of using Delta-Star "JT-1" interrupters. For full particulars write the factory or nearest district representative.

"JT-1" Interrupter mounted on 115 kv "MK-40" disconnect.



Installation of "JT-1" Interrupters on 115 kv "MK-40" 3-pole group operated switches. Photo shows blade position immediately after arc was extinguished.

WHEN YOU WANT THE BEST IN HIGH VOLTAGE SWITCHING EQUIPMENT SPECIFY DELTA-STAR

DELTA-STAR ELECTRIC DIVISION

H. K. PORTER COMPANY, INC.
2437 FULTON STREET, CHICAGO 12, ILLINOIS
DISTRICT OFFICES IN PRINCIPAL CITIES

"A shipyard is a graveyard we need top quality

says INGALLS SHIPBUILDING COMPANY,
world-famous shipbuilder, Pascagoula, Mississippi

At this vast shipyard, Ingalls has 1200 welding machines, and 1000 welders to man them. The Amerclad Welding Cable is run at top amperage 16 to 24 hours a day. It is dragged over razor-edged steel scrap and battered under heavy loads. It comes into contact with fresh welds while they are still red hot, and it is constantly showered with flaming slag from the burners' torches.

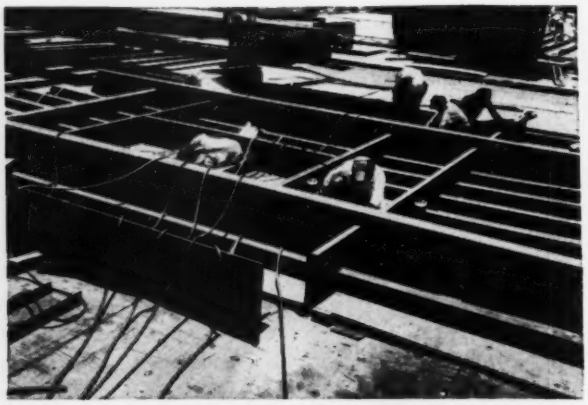
Mr. C. A. Guynn is the Master Mechanic at Ingalls in charge of all maintenance and service. He says this: "We're an all-welded shipbuilder, and we can't stand lost production time due to faulty cable. Our cable has to withstand heat and abuse, and it has to be *flexible*. An extra-flexible cable like Amerclad is easy on the welder's wrists, and it lasts *twice* as long as cables that lack this feature."

This great shipyard uses 60,000 feet of welding cable a year. But whether you use 60,000 feet or 600; whether you need a rugged cable for welding machines, power shovels or electric hand drills—there's a tough Amerclad design to give you the very best service life.

Send the coupon for more information about U·S·S Amerclad.

AMERICAN STEEL & WIRE DIVISION, UNITED STATES STEEL CORPORATION, GENERAL OFFICES: CLEVELAND, OHIO
COLUMBIA-GENEVA STEEL DIVISION, SAN FRANCISCO, PACIFIC COAST DISTRIBUTORS • TENNESSEE COAL & IRON DIVISION, FAIRFIELD, ALA., SOUTHERN DISTRIBUTORS
UNITED STATES STEEL EXPORT COMPANY, NEW YORK

Ingalls uses lots of Amerclad for portable power tools. Here, it powers a half-inch electric drill used to bore 6-inch shoring timbers.



This is a typical shipyard operating condition. The cable is exposed to all kinds of weather, and dragged over sharp steel plates and beams.

A STANDARD CABLE FOR

▼ asbestos wire and cable ▼ shovel & dredge cable
▼ paper & varnished cambric cable
▼ aerial, underground & submarine cable

AMERICAN STEEL & WIRE DIVISION · USS · AMERICAN ELECTRICAL WIRE AND CABLE · UNITED STATES STEEL

U·S·S AMERICAN ELECTRICAL

for poor cable—
products like Amerclad"

EVERY SPECIAL JOB

▼ mold cured portable cord

▼ machine tool & building wire

▼ special purpose wire & cable

WIRE & CABLE

USS

SEND THE COUPON

American Steel & Wire
Room J-103, Rockefeller Building
Cleveland 13, Ohio

☐ Please give me more information about Amerclad.
☐ I'd like to talk to your representative.

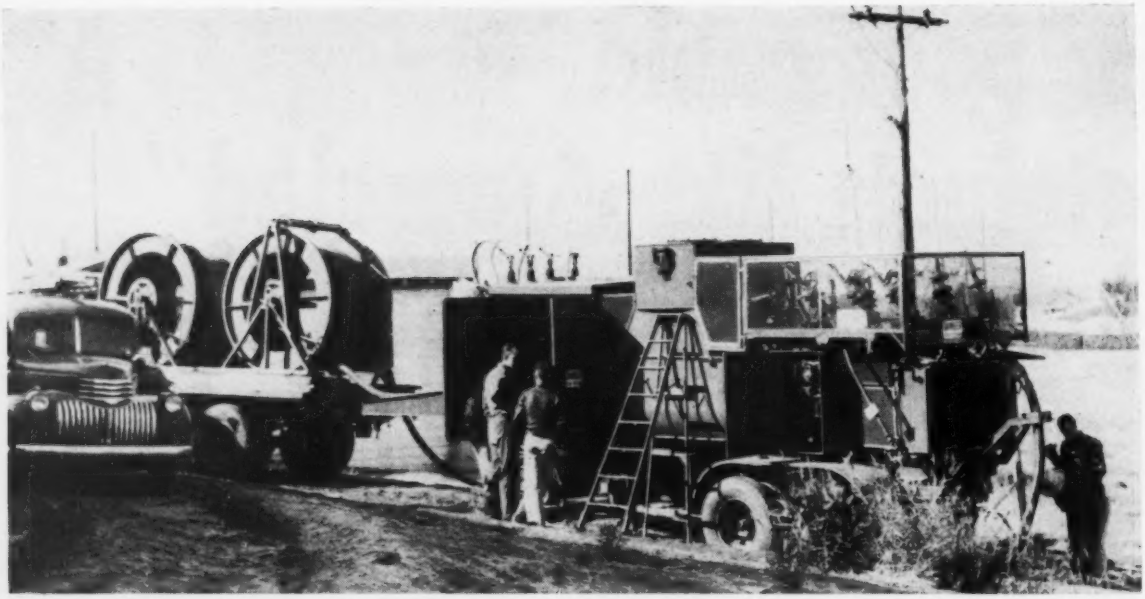
Name .....

Firm .....

Address .....

City ..... State.....

UNITED STATES STEEL



MOBILE SUBSTATION gave 11 years service and taught many lessons which will be included in recently ordered additional units

Experience Suggests Changes in New Mobile Substations

ROY F. STUART, Field Engineer, Substations, Pacific Gas & Electric Co, San Francisco, Calif.

Two additional mobile substations and a mobile transformer ordered by Pacific Gas & Electric Co have 12 specifications tempered by eleven years' experience with original mobile unit. All modifications have been found necessary to minimize damage and failures from road shock and vibration, to simplify placing unit in operation or maintaining it, or to provide adequate protection.

New mobile substations include a 2,500-kva, FOA, three-phase transformer complete with low-voltage switchgear and arranged for tap changing under load. This substation, similar to the original unit, will provide for year-round maintenance of unit substations rated 2,000-kva, with primary voltages of 24 kv or 12 kv and secondaries of 4.16 kv. With two mobile substations of this rating, one will always be ready for emergencies.

Need for the second 2,500-kva unit arose as number of unit substations grew from 15 in 1942 to 102 at end of 1952. Further, the company's original policy of reserving the mobile substation for emergencies only during winter peak was altered in 1951 when unit had to be used to relieve overloaded substations and carry loads during construction changes.

In recent years, 33 larger unit substations have been added to the company's system. These have been mostly 5,000-kva units with 60-kv primary and 12.48-kv or 4.16-kv secondary voltages. A three-phase 4,500-kva mobile substation has been ordered for maintenance at these stations and for emergencies. It will be complete with low voltage switchgear and arranged for tap changing under load.

Unit will serve in emergencies throughout the system for 70 conventional substations of 5,000-kva capacity or less that are not equipped with spare transformers. It also will be used to expedite transformer changes and station reconstruction.

The third mobile unit is a 5,000-kva, single-phase transformer, with 60-kv primary and 119% tap, 12.9-kv and 4.3-kv secondary, and 2.4-kv tertiary. Mobile transformer will act as spare for 176 conventional substations with capacities 15,000 kva and below. It will be entirely self-contained but without provision for tap changing under load nor low voltage switchgear.

When specifications for new mobile units were prepared, experience with original mobile unit suggested items be included in addition to those specified in NEMA Publications 206 and 207, 1952. These items are applicable to all three units:

1. Use stranded conductor for all control and motor wiring. Several failures occurred in solid wire in original unit.

2. Support all conduit adequately.

3. Supply all oil piping with welded joints and flange connections. Threaded connections are unsatisfactory for mobile service.

4. Furnish oil piping with valves between heat exchangers and main tank. This allows maintenance of FOA cooling equipment without first drawing down oil in transformer tank.

5. Provide fans and pumps with individual switches or other disconnecting means to expedite fault finding.

6. Furnish forced oil systems with flow type of relay to trip secondary breaker upon failure of oil circulation. In single-phase unit, terminal block will enable flow relay circuit to be connected externally to trip existing station protective equipment.

7. Install units on dual-axle semi-trailers. Original unit

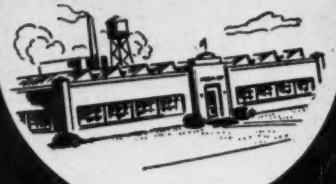
(Continued on page 154)

3 MARKETS

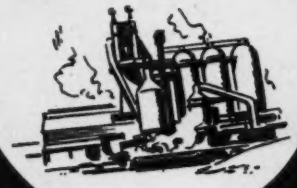
3 SWITCH LINES

1 RESIDENTIAL AND COMMERCIAL

2 COMMERCIAL AND INDUSTRIAL



3 HEAVY INDUSTRIAL



1 GENERAL USE (TYPE G)

Designed for residential and commercial applications where price is limiting and the service factor is not great.

General Purpose NEMA I

Raintight NEMA III

2 STANDARD DUTY (TYPE S)

Designed for industrial and commercial jobs where both service factor and price are important. Meets requirements for Type A switches.

General Purpose NEMA I

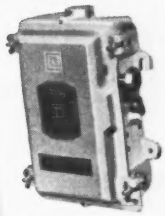
Raintight NEMA III

3 HEAVY DUTY (TYPE H)

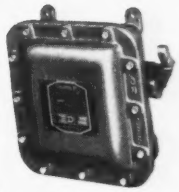
Designed for mass production industries where price is secondary to continuous performance and maximum safety under severe service.

General Purpose NEMA I

Special Industry NEMA XII

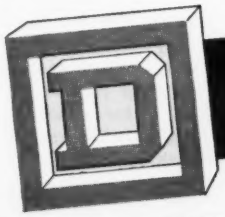


Water-tight; Dust-tight NEMA IV, V



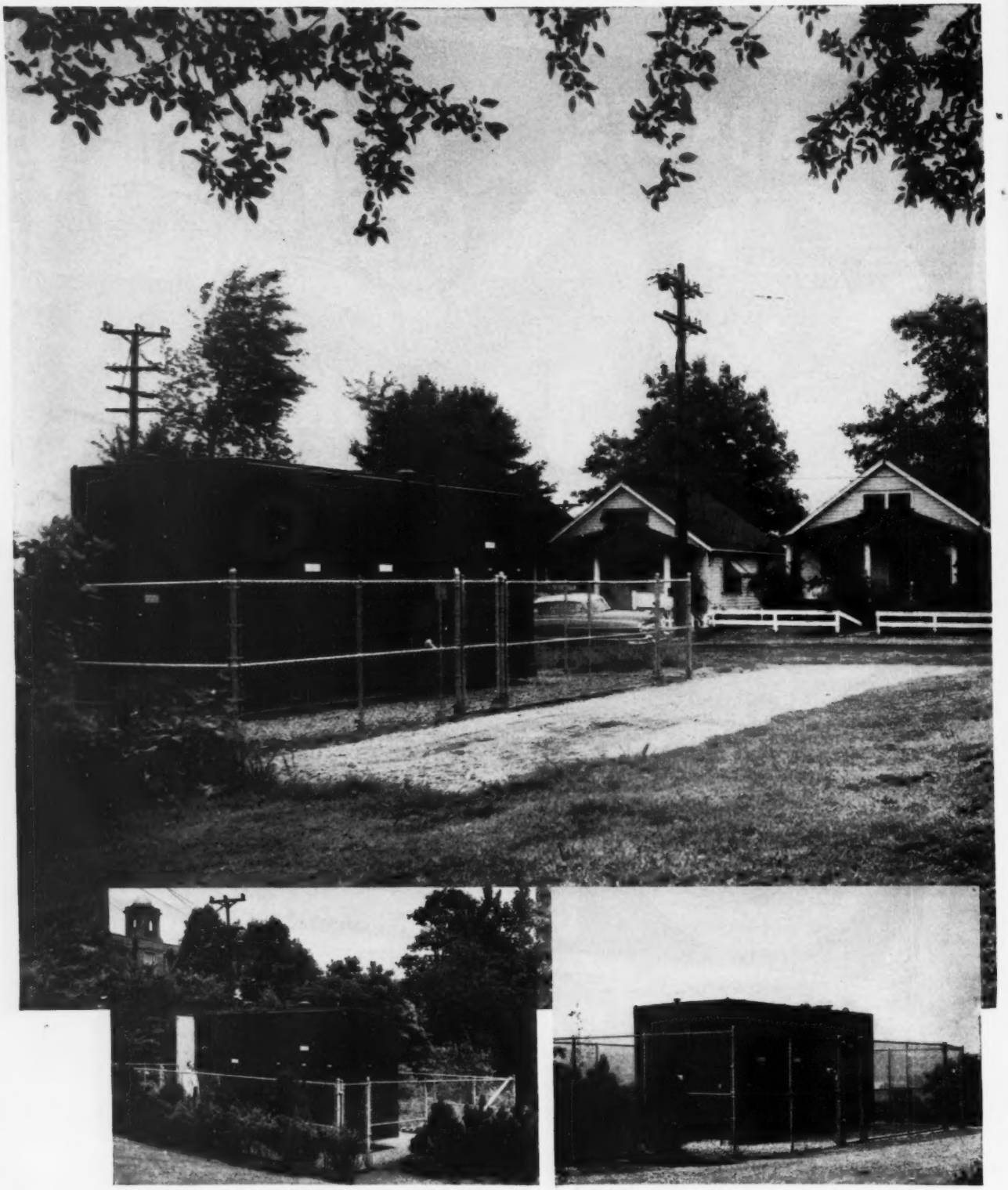
Explosion Resisting NEMA VII, IX

ASK YOUR ELECTRICAL DISTRIBUTOR FOR SQUARE D PRODUCTS



SQUARE D COMPANY

1903 • **50** YEARS OF DESIGN LEADERSHIP • 1953



This "CSP®" Power Transformer, rated 2000 kva, HV 22.9 kv, LV 4360 volts, was designed by Westinghouse in cooperation with Duquesne Light Co. of Pittsburgh, to meet their specific requirements. Installed in North Bessemer, Pa., it is neat in appearance, contains complete high and low-voltage switchgear, metering and protective equipment.

"Contoured-design" units, like this installation in McKeesport, Pa., may help solve substation problems for you, too. Complete enclosure enhances the safety factor, simplifies landscaping problems. Ask your Westinghouse representative for further information, or write direct to Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pa.

"One of the best neighbors I've ever had . . . !"

"The Westinghouse substation next to my house at 1222 Twenty-fifth Street Extension, Beaver Falls, Pennsylvania, is one of the best neighbors I've ever had," says Mrs. Roy W. Thompson, shown at the side entrance to her home.

"Recently I acquired a new neighbor, the one shown here. Westinghouse Electric Corporation and Duquesne Light Company, who worked together to develop this unit, call it a contoured-design, single-circuit substation. I'm not sure what all that means, but I can see why they call it contoured. It's completely enclosed in what looks like a large cabinet—not at all like some substations I've seen . . . the Duquesne Light people have explained to me that the enclosure not only makes the installation attractive, but completely safe, and that even without the fence there would be no danger. And, after Duquesne Light shrubs around the fence, we'll hardly know it's there because it certainly is quiet. Even my TV reception is better—they say that's because of better voltage regulation. Maybe so, anyway, I like my new neighbor."

J-70710

YOU CAN BE SURE . . . IF IT'S

Westinghouse

Changes in Substations

(*Continued from page* 150)

was installed on three-axle full trailer, but was later converted to semi-trailer for better maneuverability and to eliminate loading of truck to gain necessary traction.

8. Arrange units so that high-voltage bushings will be at rear, as on original unit. With high-voltage bushings at rear, trailer may be maneuvered so that short high voltage connections can be made conveniently.

9. Arrange axle loading and dimensions of all mobile units, when coupled to dual axle tractors, so that they are less than allowed under state vehicle code. This obviates need for special permits to move equipment, with subsequent restrictions on speed, routes, and hours of travel. Capacity rating of 4,500-kva unit was based entirely on this requirement.

These items are applicable to three-phase units only:

1. Provide phase rotation relay to prevent closing of secondary breaker unless fan and pump rotation are correct.

2. Furnish fan and pump motor circuits with reversing switch to obtain correct rotation.

3. Provide three potential transformers on load side of secondary breaker to check phasing across breaker before closing. Include phase checking lights also. This arrangement, added to original unit, saves considerable time when placing unit in service.

Card System Simplifies Maintenance Scheduling

A. W. HALL, Plant Superintendent, Murray Gill Plant, Kansas Gas & Electric Co, Wichita

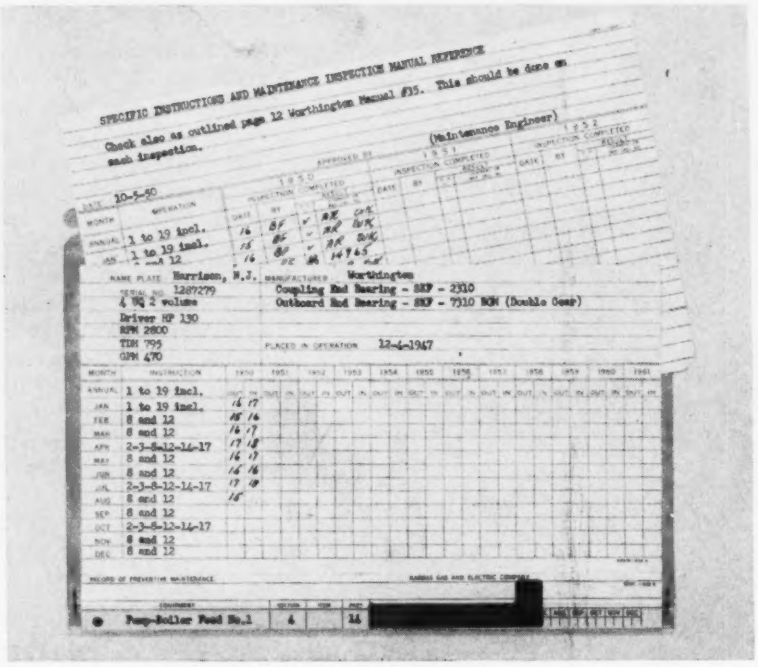
Like other electric utilities, Kansas Gas & Electric Co has been looking for better methods to keep a check on power plant equipment.

The company has practiced preventive maintenance for a number of years, relying upon a system of scheduled inspections. In recent years, however, many new types of equipment have been installed.

To meet this situation, a simplified method for handling inspection records was developed by production, maintenance, and office personnel and put into effect at the Murray Gill plant. The system overcomes objections but retains valuable features of the old program.

Under the former procedure, an equipment list was set up on master cards in a card index system. Equipment was catalogued and listed on separate cards. Name plate data, manufacturer's work order number, date of purchase, and other pertinent information were also recorded. The card listed inspections required by particular pieces of equipment, date inspections were to be performed, and their nature, which was indicated by a code number.

To minimize the introduction of new procedure this method was changed only slightly in the new system. New master cards showed the same basic information as previous cards. A significant change was provision for a 10-year inspection record.



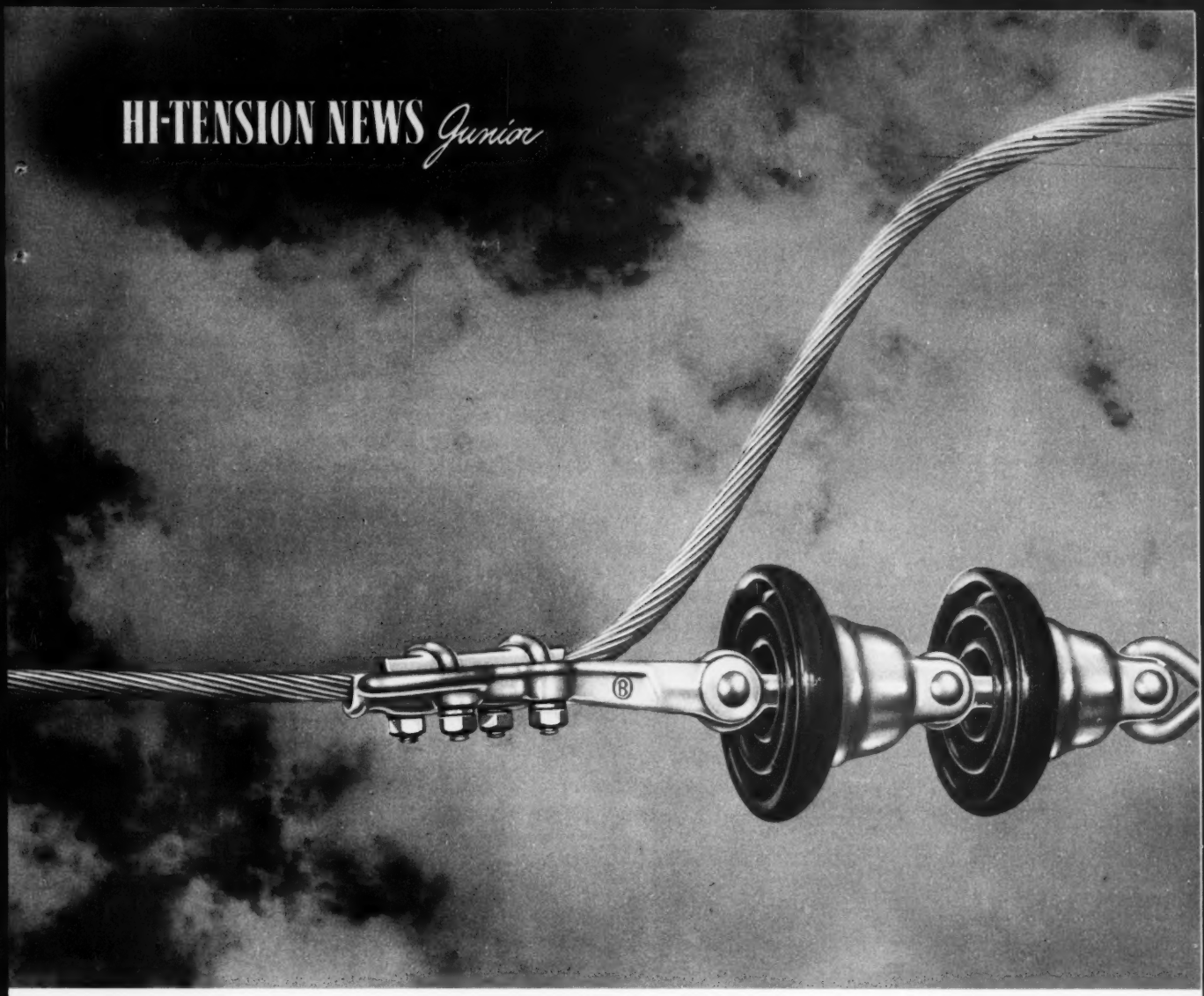
MASTER CARD is set up for each piece of equipment and records the dates of monthly inspections over a 10 year period. Inspection card can be used for three years and records completed inspections and detailed comments as to specific conditions of inspection

Simplifies Orders . . . Greatest need for streamlining the old system was in issuing work orders to maintenance personnel. Under the previous system, master cards were screened by office clerks the end of each month. For each device that showed a required inspection, clerks made out a slip showing the equipment name and code number or numbers of the inspections required. These slips were sent to supervisors who assigned them to maintenance employees. Completed inspections were noted and slips returned to the office for checking and filing.

Under the new system, the slips have been replaced by cards that can be filed with the corresponding master card in the Kardex file. Cards provide space for the inspection required each month, date performed, employee carrying out the inspection, and spectial notations on each.

Bottom of the master card is visible in the file and is imprinted with months of the year. A sliding tab, moving through a slot in the bottom of the card, enables the clerk to indicate in which month an inspection

(*Continued on page* 159)



Is this what you've been looking for?

— a Good Deadend Clamp for Large Diameter Aluminum Primaries

Maybe you have been faced with this problem, too. You want to use one of the larger aluminum or ACSR conductors for a primary distribution line, but are forced to take a poor compromise in picking deadend clamps.

Look over the modernized O-B Strateline clamp design. It's based on a well-tried model -- it is no experiment! It covers the full range of primary conductor sections, with capacity to spare, in only five basic sizes. It is slim, to provide maximum clearance and easy application of protectors for hot line work. It has a safety factor of three or better for holding strength, but does not demand a premium price for clamping power you'll never use.

Several engineers have told us the Strateline is just the distribution clamp they have been looking for. It may also fit into some of your requirements.

Ohio Brass

MANSFIELD, OHIO, U.S.A.

Hurricane exposure on this section of line demands special strength in conductor attachments -- a matter of routine with Clamptops. In less exacting service, the Clamptop prevents conductor chafing by maintaining a tight, slipless grip on the conductor at the insulator head.

How to speed up construction work—yet make it much safer

Clamptop Principle Does Away With Troublesome, Dangerous Tie Wire Installations

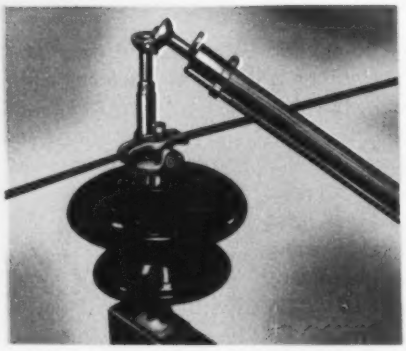
Next time you see a hot line crew change a pintype insulator, try this: First, time the job. Second, when the new tie wire is being wrapped, notice the large zone of line potential described by the moving end of that tie. If the hot stick slips, observe the tendency of the tie wire to spring out of control and, remember, the flying end of this tie carries line potential.

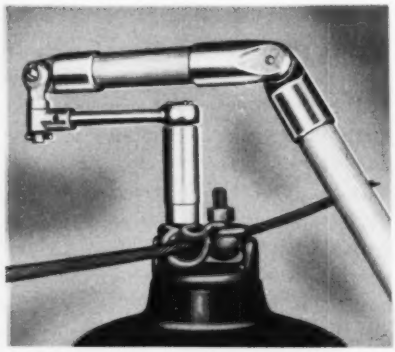
Now, make a comparison. A crew, with simple standard hot line tools, can make a conductor attachment on a Clamptop insulator in about two minutes -- or less with practice. The entire zone of line potential is about the size of a man's fist, and is stationary! A slip of the hot tool merely disconnects that tool from voltage. There is no large, indefinite moving zone around the insulator where line voltage can accidentally exist.

Conclusion: The job is much faster and, as for safety, there is scarcely any comparison. Furthermore, whether applied "hot" or "cold", the Clamptop produces a permanent conductor attachment that won't work loose by strains or vibration, and is stronger than the best tie.

If for no other reason, as part of your general information on insulator developments, you should have first-hand acquaintance with the modern O-B Clamptop principle. . . . And if your experience is typical, once it is tried it will be on your system permanently.

In ordinary construction work, men make fast time "tieing-in" Clamptops. A few turns of a hex nut with a hand wrench completes the job -- stronger and more permanent than a tie wire.





Leading manufacturers of hot line tools make various designs of wrenches excellently adapted to the installation of Clamptop insulators. With these tools, work progresses almost as fast as by hand. Safety of the operation is obvious to anyone watching a Clamptop installation.

How Big Is A 1-Inch Cotter Pin?

Hardware Replacement Components Are Now Described and Listed In O-B's New Number 28 Catalog

Let's assume a plain brass cotter pin that has an over-all length of 1⅜ inch and, when squeezed tightly shut, has a diameter of 5/32 inch. This is a common item in many pieces of line hardware. But, ignoring the loop, the shank portion measures only 1 inch and, since the two legs are always slightly spread, it measures 3/16 inch across the end.

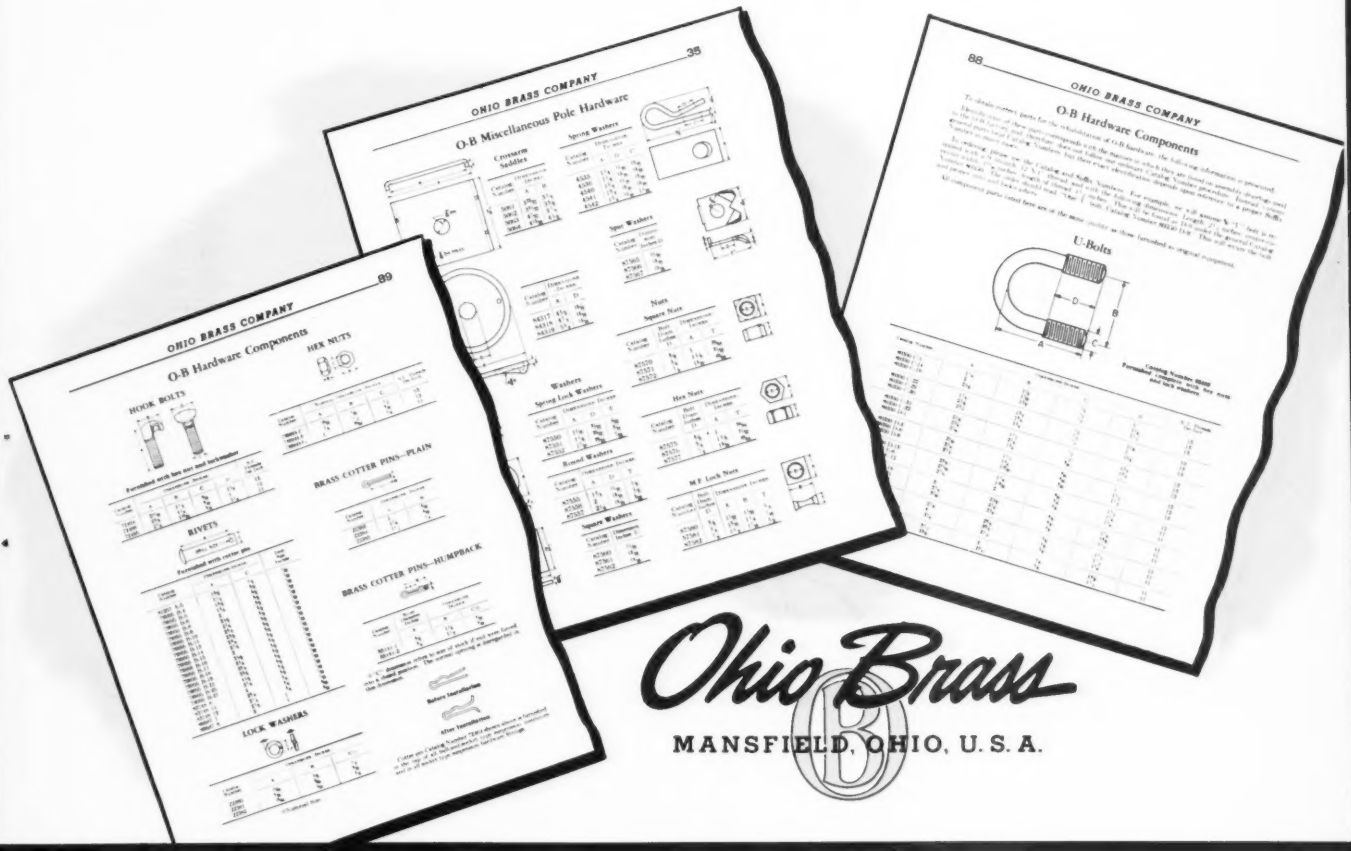
You want some of these cotter pins for replacement. What do you say on the order?

For years we have been trying to get along with this problem. Sometimes, postage and telephone calls amounted to nearly as much as the material, by the time the customer and ourselves thoroughly understood each other. In other cases, the buyer in desperation simply fastened an old piece to his purchase order and said " . . . a thousand like this."

Now you can turn to a page in the new O-B Insulator Catalog and see descriptive drawings with catalog listings covering the full range of U-bolts, hook bolts, nuts, rivets, washers, cotter pins, and all the other items required for the rehabilitation of line hardware and crossarm pins. You will be supplied with material properly adapted to the job and equal in quality to the original parts. There will be no confusion in describing your exact requirement.

We don't anticipate getting rich on this business, but we believe it will save a lot of gray hairs in Purchasing Departments, and it is indicative of O-B's effort to do an intelligent job of cataloging material.

. . . And by the way, have you seen the new Number 28 O-B Insulator Catalog?



Ohio Brass

MANSFIELD, OHIO, U. S. A.

HI-TENSION NEWS *Junior*

New levels of apparatus protection and arrester durability

Now offered by Thorex Multi-Purpose, Type MP

Compared to previous station-protective arresters, the Thorex Multi-Purpose offers a reduction of 10% to 15% on IR discharge voltages. This is coupled with exceptionally low tolerances of +5% on IR discharge voltage and +10% on series gap sparkover voltage. The result is a new order of wide protective margin between maximum arrester performance and minimum apparatus insulation strength.

•

Thorex Multi-Purpose arresters provide generous thermal capacity for the rigorous service imposed by long, high voltage networks, large underground cable installations, and heavy static capacitor banks, where long-duration disturbances may be encountered. They likewise excel in lightning-protective performance. These arresters pass all American technical standards for heaviest duty, not only with ease but with great un-used reserve.

•

Throughout the entire voltage range from 3 kv to beyond 300 kv, Thorex Multi-Purpose arresters are self-supporting. Elimination of bracing structures is a material economy in the higher voltages.

•

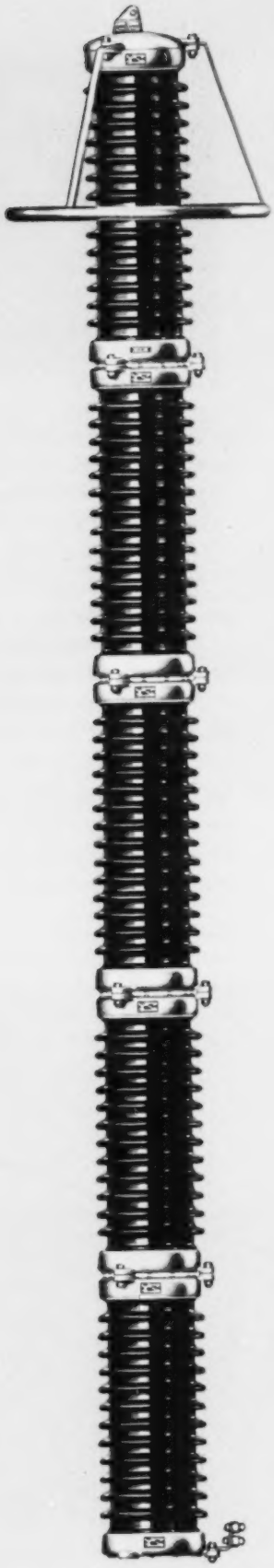
Extensive new research has been expended in the design of radically improved valve blocks of high thermal capacity, an ingenious and novel spark gap with unusual interrupting ability, and internal grading provisions at higher voltages to offset the otherwise adverse effect of semi-conductive surface contamination.

•

Thorex Multi-Purpose, Type MP, lightning arresters now offer you hitherto unattained levels of apparatus protection and arrester durability. Your O-B representative is prepared to discuss their many possibilities with you.

Ohio Brass

MANSFIELD, OHIO, U. S. A.



4404-H

Card System

(*Continued from page* 154)

is to be performed. Files are screened at the end of each month by means of the tab indicator and cards for equipment to be inspected are removed from the pocket.

Removal date is noted on the master card and the inspection card is sent to the appropriate supervisor. Upon completion of the inspection, proper notation is made on the card and it is returned to the office. Completion date is noted on the master card and the inspection card is returned to the pocket file.

An important change is the space provision for 3-year record on the card, which eliminates typing of inspection slips each month. In turn, plant maintenance personnel are assured of receiving inspection cards on time.

There has been a substantial reduction in paperwork by plant and office personnel. Longer use of single cards, together with their small size permits compact filing, easy availability for reference, and lessened demand for storage space. The new procedures are now being put into effect at other power plants on the system.

Mobile Cradle Handles Heavy Chain-Fall

E. J. MAGYAR, Maintenance Man, Tidd Plant, Ohio Power Co, Brilliant, Ohio

A cradle that may be attached to a fork-lift truck boom has been developed to simplify and expedite handling 5-ton chainfalls. With this rig, man-hours for relocating a chain fall, to work on six boiler-feed pumps and other plant jobs, have been cut 80% and safety has been improved.

The chain fall is moved from one trolley to another by the cradle fitted lift truck in 20 to 30 min. One man can perform this operation but generally two men are used.

Formerly, this task required 45 to 60 min of three men's time to rig come-alongs in two places and another 15 min to move the rigging so the chain fall could be used in new location. Occasionally these operations required 6 man-hours. Hence, man-hours required and delays are reduced 80% or more by using the new rig.

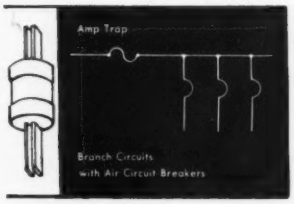
Safer working conditions exist by

(*Continued on page* 162)

Amp-trap®

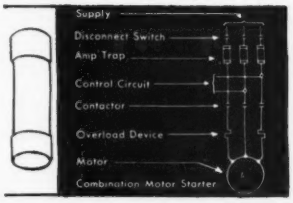
CHOPS DANGEROUS SHORT-CIRCUITS DOWN TO SIZE

Amp-trap with CIRCUIT-BREAKERS



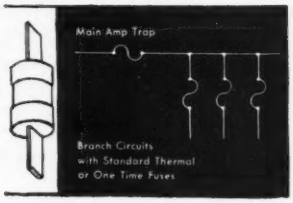
Amp-trap's lightning fast current limiting action makes it ideal for use in locations where the available short circuit current exceeds the circuit breaker's interrupting rating. It gives back-up, short-circuit protection to overload devices and clears a heavy short-circuit before the circuit breaker can open. Yet, the circuit breaker will open within its rating without blowing the Amp-trap.

Amp-trap with MOTOR CONTROLLERS



Amp-trap's small "let-through" current (low I^2t) gives positive protection to over current devices and contacts against high thermal or magnetic stress caused by super currents as high as 100,000 amperes R.M.S. at rated voltage. Amp-trap's operating characteristics limit stress on motor controllers, conductors, panel boards and load centers.

Amp-trap with PLUG-IN BUSWAY



Amp-trap's fast "chop-off" on high amperage short-circuit gives short-circuit protection to ordinary fuses and to isolate branch circuits without affecting feeder circuits or other branches supplied from the main busway. Actual tests on high short-circuit current have shown how Amp-trap amplifies plug-in busway momentary ratings by limiting magnetic and thermal stresses, and permits application of designs having limited withstanding ability on high powered installations.

Amp-trap is safe, efficient, economical short-circuit protection for electrical apparatus against large available short-circuit currents.

OUR 60th YEAR — FROM EDISON TO ELECTRONICS — Est. 1893

AMP-TRAP — "Awake At The Switch"

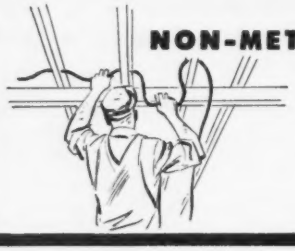
In Canada — Powerlite Devices, LTD.

THE CHASE-SHAWMUT CO.

370 MERRIMAC STREET • NEWBURYPORT, MASSACHUSETTS

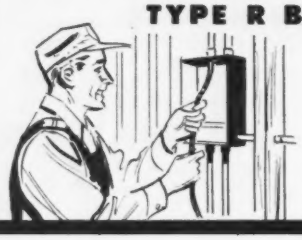
Amp-trap Tri-onic td C-O-T Trionet ONE-O-T TIME FUSE WIRE

always your best buy... BUILDING WIRE AND

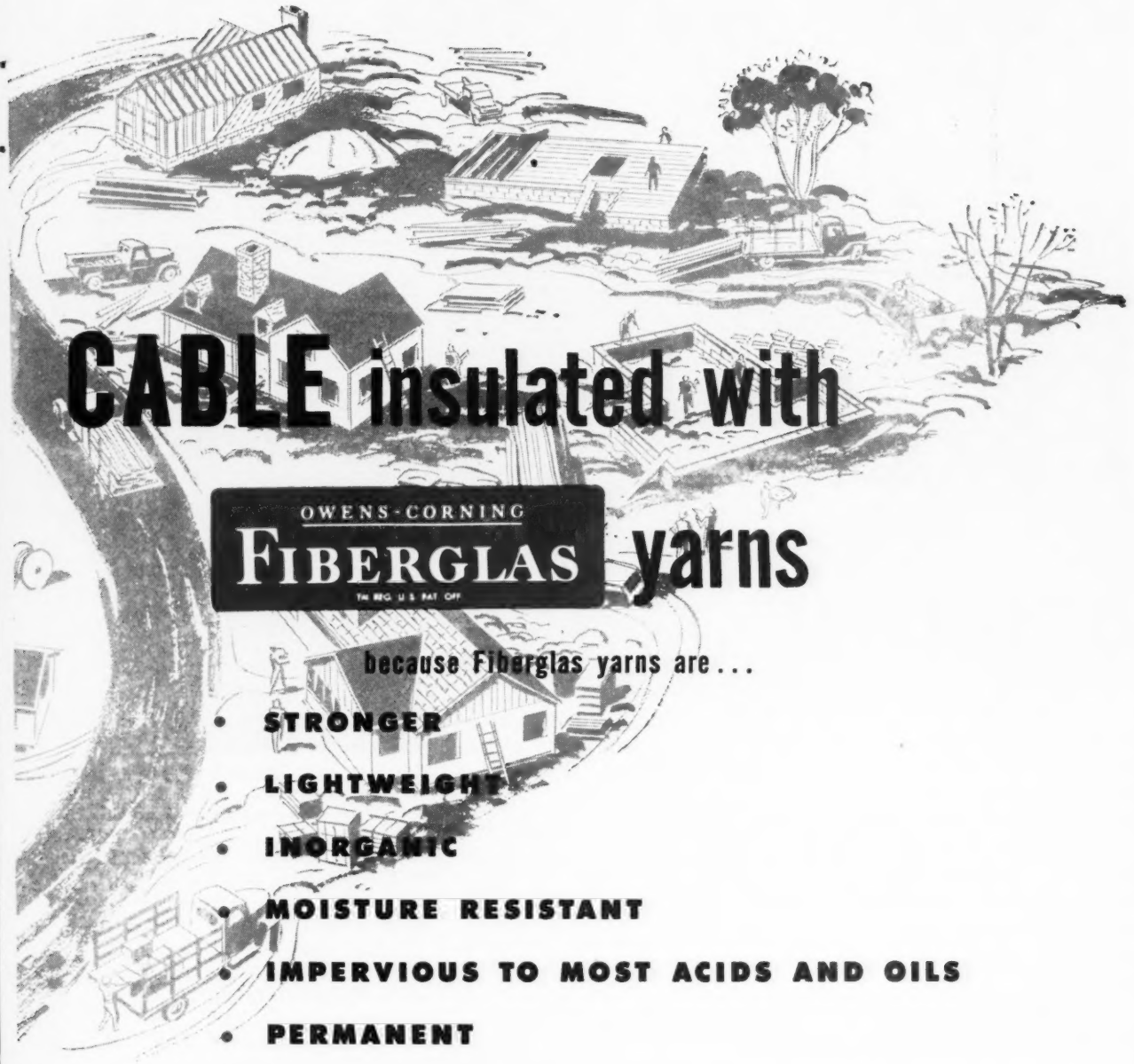


NON-METALLIC SHEATHED CABLE . . . with Fiberglas* textiles in the protective outer braid as well as in the strength-giving filler . . . is lighter, tougher, easier to install. Fiberglas textiles provide a more permanent reinforcement for the outer protective sheath because they're inorganic, won't rot when exposed to moisture and resist most acids and oils.

SERVICE ENTRANCE AND DROP CABLES . . . Fiberglas textiles strengthen conductor coverings, moisture seals, outer coverings—help give service cables the extra protection needed to withstand rough treatment during installation and to resist the temperature and weather extremes that attack cable life.



TYPE R BUILDING WIRE made with Fiberglas yarns means lighter, smaller-diameter wires which are easier to handle, easier to pull through conduits. They permit the use of more conductors per conduit—make possible the increase of conduit current-carrying capacities. Users of armored cable can benefit, too, from Underwriters-approved reductions in steel armor weights when Fiberglas yarn-covered conductors are specified.



CABLE insulated with OWENS-CORNING FIBERGLAS yarns

TM REG. U.S. PAT. OFF.

because Fiberglas yarns are . . .

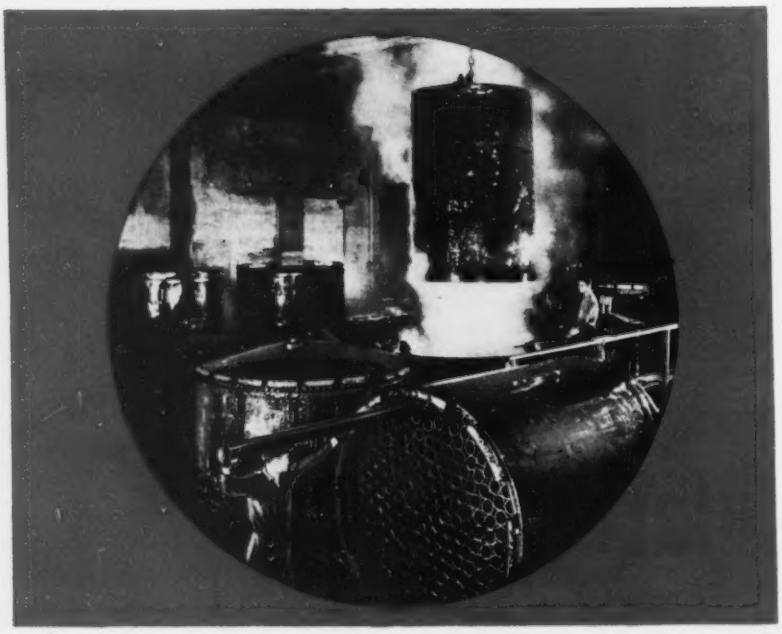
- **STRONGER**
- **LIGHTWEIGHT**
- **INORGANIC**
- **MOISTURE RESISTANT**
- **IMPERVIOUS TO MOST ACIDS AND OILS**
- **PERMANENT**

Building wire and cable made with Fiberglas yarn is available in all standard sizes from leading electrical suppliers. Next time you order, be sure to specify wire and cable made with Fiberglas yarns . . . always your best buy!

OWENS-CORNING FIBERGLAS CORPORATION

TEXTILE PRODUCTS DIVISION, 16 EAST 56TH STREET, NEW YORK 22, NEW YORK

*Fiberglas is the trade mark (Reg. U. S. Pat. Off.) of Owens-Corning Fiberglas Corporation for a variety of products made of or with fibers of glass



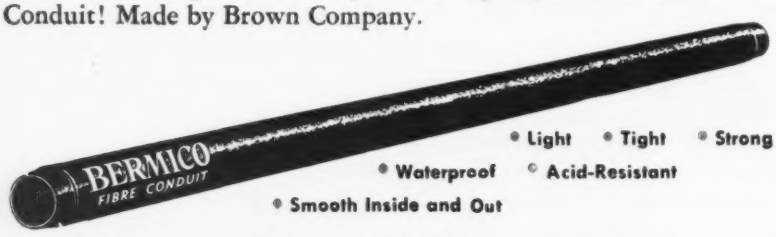
"Blending"

BERMICO® FIBRE CONDUIT

. . . for perfect uniformity Here, in the impregnation phase of Bermico's production, wood fibre and coal tar pitch become as *one* substance. Under vacuum, sturdy wood fibre tubes are thoroughly infused with tough preservative. The result is Bermico Fibre Conduit—*completely uniform* from end to end!

Bermico's uniform impregnation is matched by: *uniform wall thickness . . . uniform diameter of bore . . . uniform quality of fibre.* This pattern of uniformity is the result of production that features automatic forming and processing . . . close controls over the drying process . . . machining of taper and length . . . four rigid factory inspections.

For the best protection for your cable specify Bermico Fibre Conduit! Made by Brown Company.



Distributed by WESTINGHOUSE Electric Supply Company.
Offices in principal cities

BROWN QUALITY COMPANY, Berlin, New Hampshire
CORPORATION, La Tuque, Quebec

SOLKA & CELLATE PULPS • SOLKA-FLOC • NIBROC PAPERS • NIBROC TOWELS • NIBROC KOWTOWLS
NIBROC TOILET TISSUE • BERMICO SEWER PIPE, CONDUIT & CORES • ONCO INSOLES • CHEMICALS

Mobile Cradle

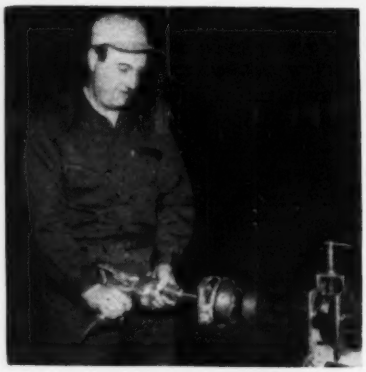
(*Continued from page* 159)

using the cradle. With manual method of moving chain fall there was always the chance that men would drop equipment or strain themselves. Now that these operations are mechanized very little hazard remains.

Trimming Tool Tapers Fibre Conduit, Saves Time

E. M. KUEHT, Superintendent, Underground Division, Wisconsin Electric Power Co, Milwaukee

A trimming and tapering tool, used in conjunction with a special vise, saves 75% of the time formerly required to trim fibre conduit ends. The tool, designed by Andrew Klein, electric distribution department, Wisconsin Electric Co, also:



TAPERING FIBRE CONDUIT ends with a trimming tool resulted in a 75% time saving. Vise will hold 3-in. long pieces of conduit

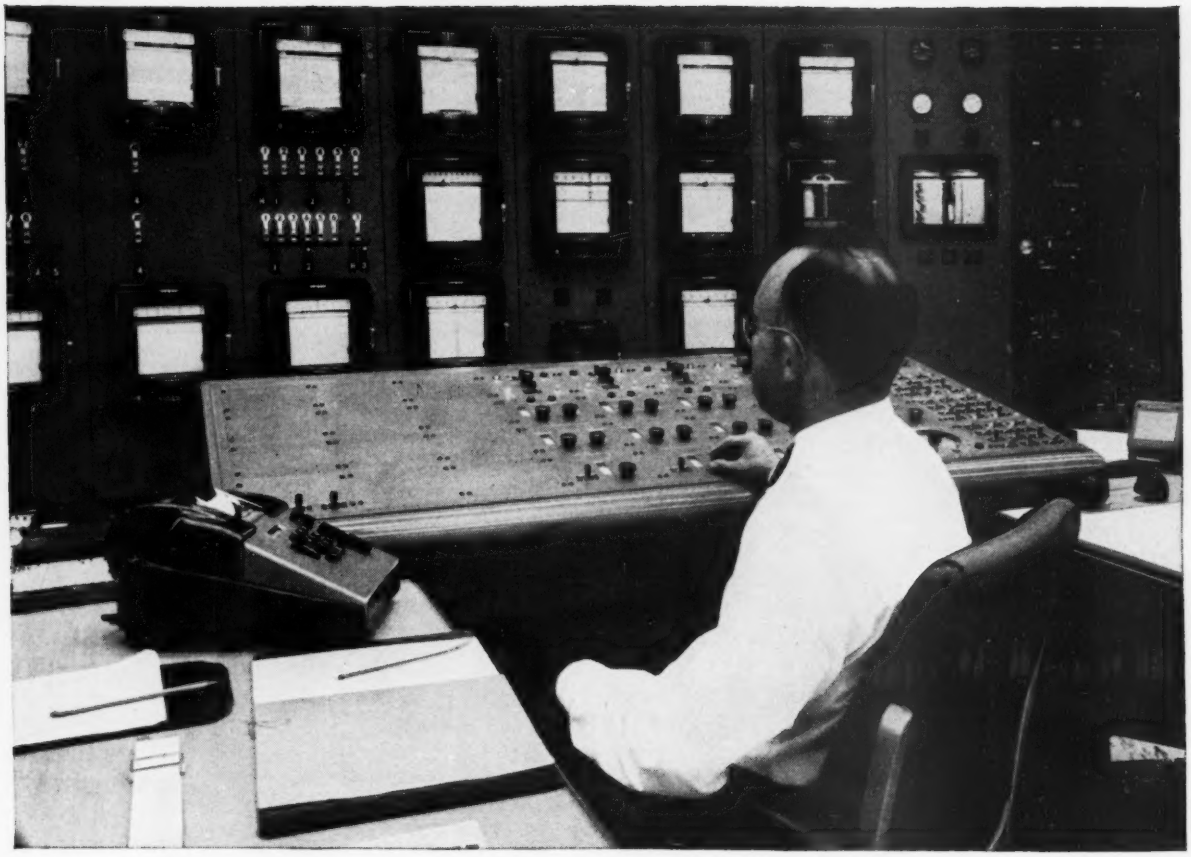
1. Makes smooth, accurate, finished tapers on conduits—like the ones made by manufacturers—to facilitate coupling of joints.

2. Permits economical salvage of short lengths and broken fibre conduits because of the tool's speed.

3. Eliminates dangers resulting from use of knives or wood chisels to trim conduit ends.

The tool is a cutting jig that fits around the fibre conduit's end, and is powered by a ½-in. electric drill. Two cutting edges attached to the tool's outer frame and protruding inward cut the taper. A cylindrical-shaped guide fits into the conduit to insure accurate tapers.

Also helpful in this operation is a conduit vise that will accommodate any length of fibre conduit from 3 in. to 8 ft. Presently available vises re-



He's solving

400,000

Load-Frequency Control Problems

This System Operator is balancing system generation against the demands of 400,000 customers on the Long Island Lighting Company system. Each of these customers is a "problem," because each expects power at the right voltage and frequency when he flips a light switch.

In order to meet these changing demands, the System Operator needs two things: First, a complete picture of system operating conditions, and second, a convenient method of making the appropriate control adjustments.

System data is supplied by the above panel-mounted Speedomax Telemeters with such accuracy that transmitting and receiving chart curves can't be told apart. Two of these Speedomax Telemeters also provide information on the power flow across an interconnecting tie line which links the Long Island system with a neighboring utility.

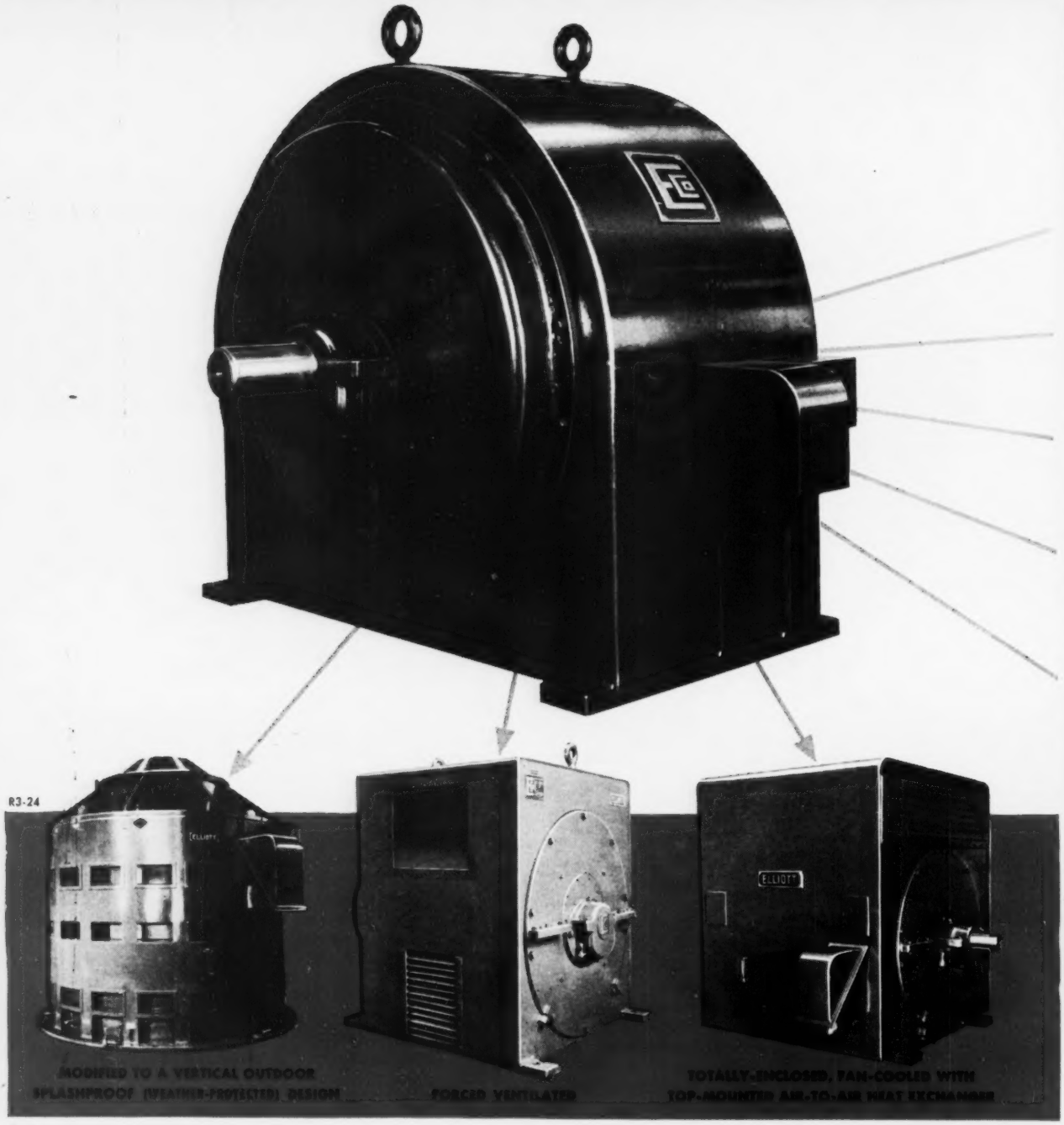
The L&N control console directly in front of the System Operator houses all dials and setters necessary for effective system regulation. In order to solve his 400,000 problems, therefore, he simply dials the correct settings.

To solve your particular Load-Frequency control problems, write to Leeds & Northrup Company, 4938 Stenton Avenue, Philadelphia 44, Pa. The response you get will be backed by know-how gained in making more than 300 Load-Frequency control installations throughout the country during the past quarter-century.

LEEDS instruments **NORTHRUP** automatic controls • furnaces

Jrl. Ad ND4-56-461(11)

With ELLIOTT "fabri-steel" you *take your choice*


R3-24
MODIFIED TO A VERTICAL OUTDOOR SPLASHPROOF (WEATHER-PROTECTED) DESIGN
FORCED VENTILATED
TOTALLY-ENCLOSED, FAN-COOLED WITH TOP-MOUNTED AIR-TO-AIR HEAT EXCHANGER

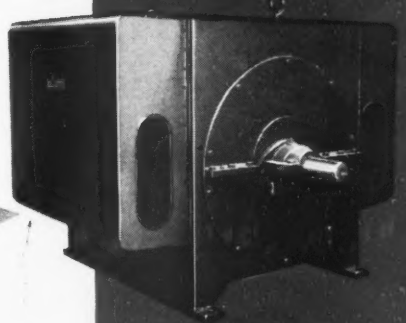
motor construction of enclosures

INDOOR SPLASHPROOF

Without change in electrical design, an Elliott Fabri-Steel motor can be provided with the enclosure required by the application. To illustrate, here is a standard Elliott drip-proof squirrel-cage induction motor, and below it the wide variety of enclosures, each adapted to special conditions, in which the same motor can be obtained.

The answer is Elliott Fabri-Steel construction—actually tailoring in metal—which combines the crack-proof strength of steel with the extreme rigidity of skillful fabrication. It's the modern way to build large motors, now recognized throughout industry, with a ready adaptability to enclosure variation impracticable by other means.

For full data on Elliott "Fabri-Steel" motors, contact your local Elliott representative or write Elliott Company, Ridgway Division, Ridgway, Pa.



OUTDOOR SPLASHPROOF (WEATHER-PROTECTED)

MOUNTED FRAME FOR TOP DISCHARGE

ELLIOTT Company
RIDGWAY DIVISION
FOR MOTORS 1-200 HP. CROCKER WHEELER DIV. AMPERE, N. J.

TOTALLY-ENCLOSED, WATER-COOLED WITH BASE-MOUNTED AIR-TO-WATER HEAT EXCHANGER

ENCLOSED SELF-(BASE) VENTILATED

Elliott FABRI-STEEL

NEW

VERSATILE
LOW COST
FISHER-
PIERCE
SERIES
64400

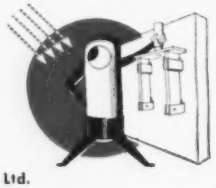
PHOTOELECTRIC CONTROL
FOR
OUTDOOR LIGHTING

The new Fisher-Pierce Series 64400 Photoelectric Control is a small, compact, lightweight 575 watt unit readily adapted to a great many mounting requirements. Appropriate accessories are available for mounting on luminaire, wood pole or cross arm, ballast, pole top, standard, mast arms, etc.

Because of its low initial cost as well as savings in wiring, other materials, and labor, it is economically feasible to use one F-P 64400 Control per lamp.

The control employs the well-known Fisher-Pierce basic circuit which has been proven by the experience of hundreds of utilities in thousands of installations. Such design improvements as etched circuitry have permitted low unit cost without sacrifice of high quality.

WRITE FOR DESCRIPTIVE LITERATURE



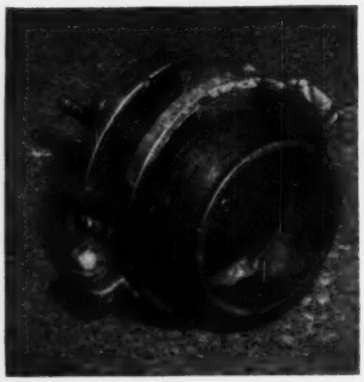
The FISHER-PIERCE CO., Inc.
82 Pearl St., So. Braintree, Boston 85, Mass.

EXPORT: PHILIPS EXPORT CORP. 100 E. 42nd STREET NEW YORK 17, N.Y.

IN CANADA: NORTHERN ELECTRIC CO., Ltd.

Trimming Tool

(*Continued from page* 162)



TRIMMING TOOL has two cutting edges for tapering conduit. It is driven by ½-in. drill

quire a minimum conduit length of 18 in. for use.

The vise is designed to hold fibre conduit rigidly and true in diameter and circumference. This permits more accurate taper cutting than can be accomplished with existing vises. The vise, which can be dismantled, and its carrier weigh 50 lb less than most apparatus of this kind.

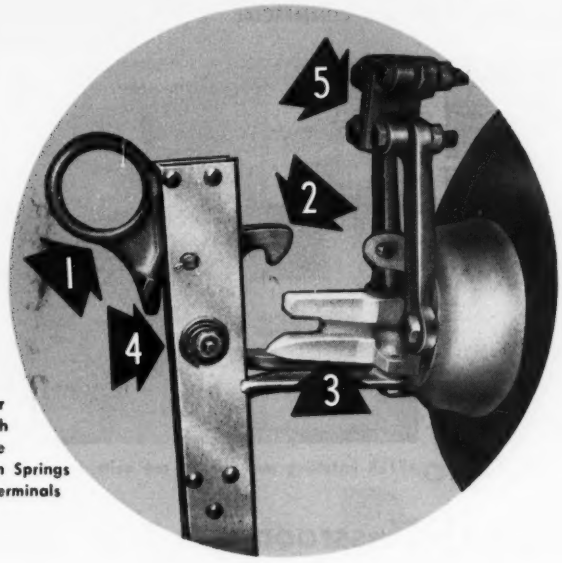
Wire Racks Multiply Globe Carrying Capacity

P. N. WOODSON, General Foreman, Street Lighting, Potomac Electric Power Co, Washington, D. C.

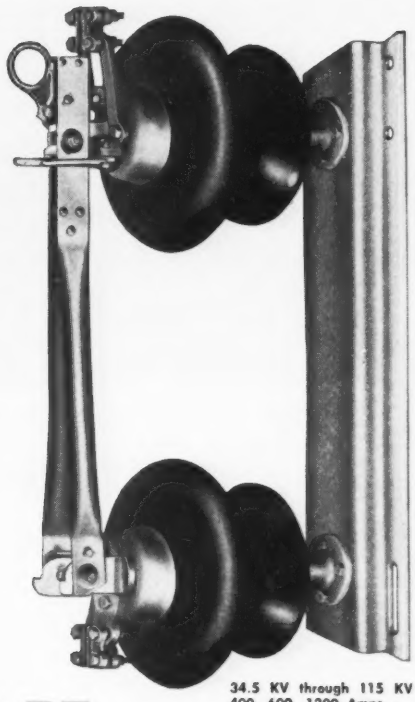
Installation of wire grille racks on the tops of all light, street lighting trucks at Potomac Electric Power Co increases the globe carrying capacity of the trucks and cuts traveling time between jobs and the service building in half.

Formerly, the light trucks could only carry four large globes. Now with the racks, 15 globes plus lamp baskets can easily be accommodated. Broken globes can be replaced when found, thus freeing the truck for other duties.

A false wooden floor with pads and slats is installed on the truck roof. Wire grilles are welded in place using angle iron supports. The ladder is mounted in a slanting position on the side of the truck to avoid interference with cab door—thus permitting operator to use door under all conditions. The truck is also equipped with 2-way radio as are 115 other Pepco trucks and cars.



1. Pryout Lever
2. Double Latch
3. Split Tongue
4. Compression Springs
5. Universal Terminals



34.5 KV through 115 KV
400, 600, 1200 Amps.

For extra ruggedness in Hook Stick Disconnect Switches

specify CHANCE BT

Hook Stick Disconnect Switches *have* to be rugged. Heavy side thrusts—when the closing force must be applied from an angle — cause some switch blades to flex and make quick, sure contacts impossible.

That's why CHANCE Hook Stick Switches are designed with emphasis on *really rigid* contact blades—like the double-trussed tubular blade that gives unequalled strength to Chance Switches from 34.5 through 115 KV . . . the heavy flat parallel bus bars that serve as blades in the 23 KV and smaller 1200 amp. switches . . . or the flange-reinforced bus bar blades on the 400 and 600 amp. switches rated 23 KV and below.

In addition to rigid blades, Chance Disconnect Switches have many other features that add up to smooth operation through many years of service. Five of these are shown in the inset above.

1. A downward pull on the extra large ring actuates a powerful pryout lever that works like a claw hammer to break ice accumulations with ease.

2. Double latch hooks lock the blade in position so firmly that even tremendous magnetic forces caused by heavy faults can't make the switch open. The latch is held securely by a non-ferrous, sleet-protected spring inside the blade end.

3. A split tongue contact always centers clip pressure directly over the contact area.

4. High contact pressure is kept constant by bronze compression springs and spherical washers.

5. Chance Disconnect Switches are equipped with time saving universal terminals that fit any conductor size you use.

All Chance switches have flanged bases that will not cut into wood structures and cause constant maintenance problems after installation. All meet NEMA and AIEE requirements and they all have passed Chance engineers' severe tests for high currents, icing, insulation characteristics and long life. Why not get full details today?

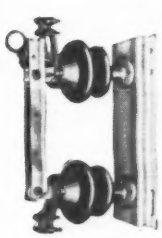
You know it's RIGHT when you specify CHANCE

ABC INDUSTRIES

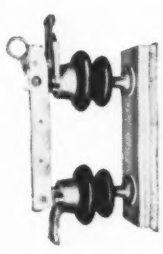
A·B·CHANCE CO·

CENTRALIA, MISSOURI
SAN FRANCISCO, CALIFORNIA

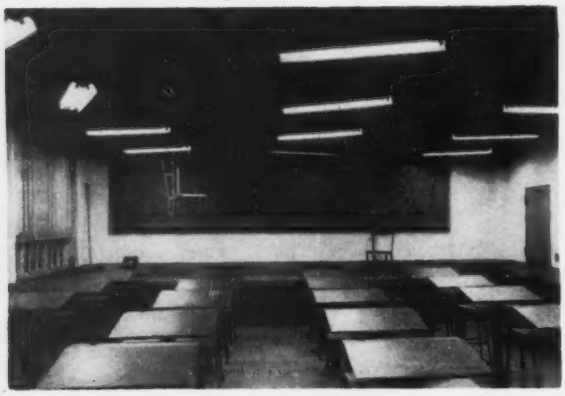
C52-6A



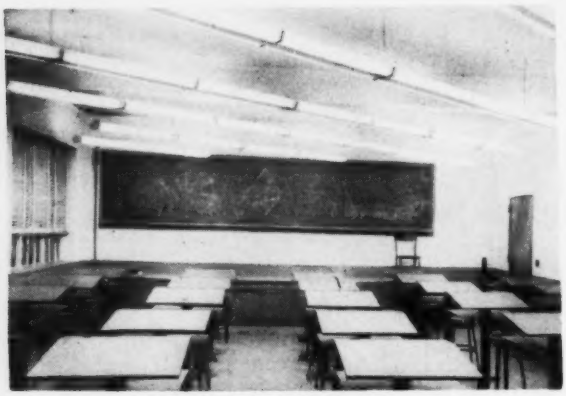
7.5 KV through 23 KV
400, 600 Amps.



7.5 KV through 23 KV
1200 Amps.



BEFORE relighting, illumination in 10 drafting rooms was 20 ft-c



AFTER installing semi-indirect row units, illumination was 50 ft-c

Georgia Tech Relights Drafting Classrooms

S. J. ANDRE, Georgia Power Co, Atlanta

Utilization of existing wiring and ceiling outlets was a principal requirement in the relighting from 20 to 50 ft-c in ten drafting classrooms of the Georgia Institute of Technology.

The rooms have white accoustical tile ceilings that were not to be cut for rewiring or relocation of outlets.

Existing lighting consisted of incandescent and fluorescent lamps in RLM fixtures, 300 outlet capacity. As shown in the pictures, the problem was solved by installing slanting rows of semi-indirect fixtures containing pairs of T-12, slimline, 3500 deg white lamps. In the larger rooms the new wattage is 3020 and in the smaller 2260, each well within the capacity of the existing wiring.

The semi-indirect fixtures were chosen in preference to an alternate suggestion of direct-indirect with low-brightness louvers. The choice rested largely on the colors of the rooms, which had white ceilings and light green walls with reflection factors of 80% and 60% respectively. The slanting rows of fixtures minimized shadow and brightness contrast.

Links Food Suppliers and Freezer Dealers

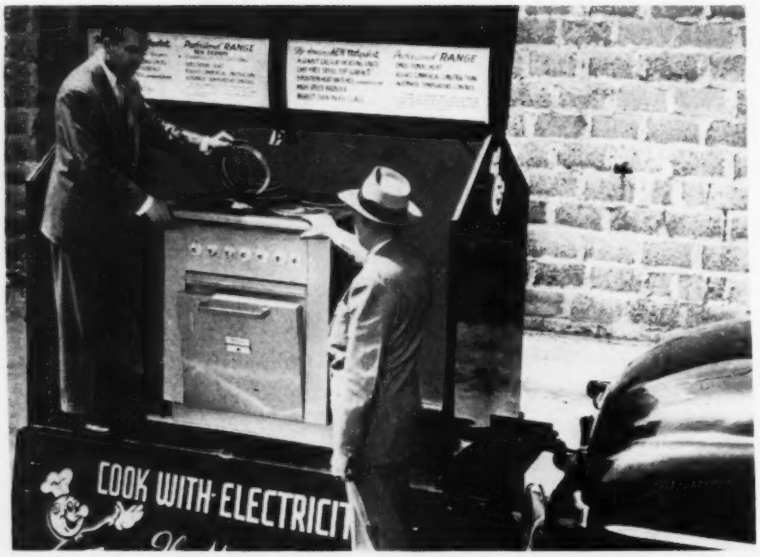
A food freezer promotional program which has recently been started enlists participation by food suppliers and General Electric Co major appliance dealers.

A directory of food suppliers who have indicated a willingness to sell food to freezer users is prepared by the local distributor.

This directory lists the food services of the suppliers, including discounts for quantity purchases and any arrangements they may have for financing food purchases.

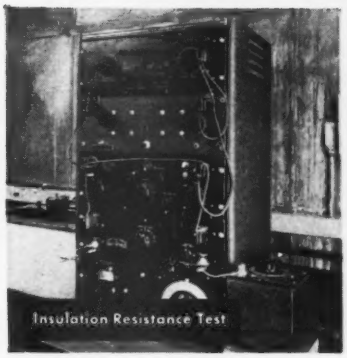
Directories are made available to dealers to furnish a copy to each freezer purchaser together with a membership card, signed by the dealer, in the "Family Benefit Food Plan."

The dealer also forwards the names of freezer purchasers to participating food suppliers so the latter can provide prospective food buyers with price sheets and other pertinent information.

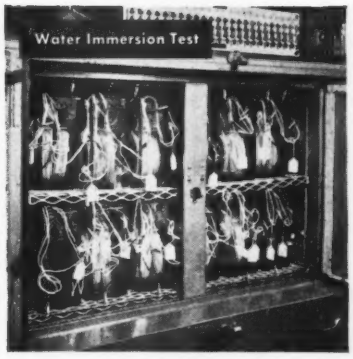


Electric Cooking Gets Around

Potomac Edison Co has had wide success with this trailer in displaying heavy duty commercial cooking equipment. The vehicle is one of the first of its kind in use. With it, utility men may take equipment to potential customers, rather than having them come to a show room. Shown displaying the trailer are C. R. Meyer, Potomac commercial representative, and J. P. Coblentz, back to camera, air conditioning and heating supervisor.



Tests from every angle prove the superiority of BAKELITE TRADE-MARK Polyethylene wire covering



Years of weathering crammed into hours . . . temperatures as low as —70 deg. C. . . . immersion in water for 24 weeks at 50 deg. C. . . . these are some of the conditions under which BAKELITE Polyethylene is tested for wire covering.

This kind of treatment pays off in actual field use, where BAKELITE Polyethylene gives unsurpassed service. It withstands abrasion, chemicals, and water immersion. The approved black compound stays flexible down to —70 deg. C., resists deformation up to 90 deg. C. It meets ASA suggested specifications (second draft; July 20, 1952) for weather-resistant wire and cable.

Wire covering of BAKELITE Poylethylene won't festoon. Extruded on the wire, its excellent physical and electrical properties provide a thinner covering with a specific gravity of only 0.94. This means lighter wire, easier handling, faster stripping and splicing.

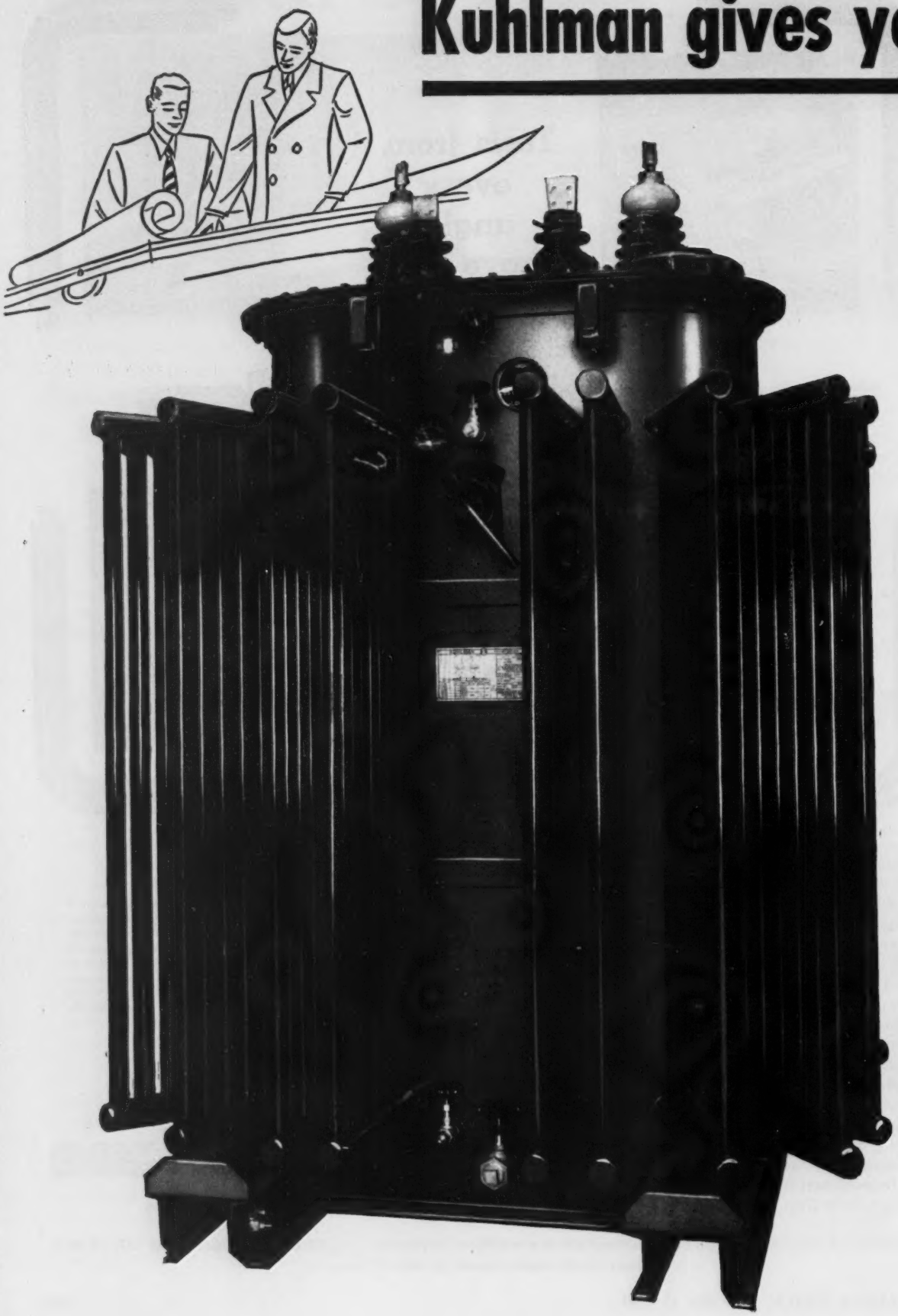
Compare other wire coverings with BAKELITE Polyethylene. Detailed facts are given in Kabelitems No. 48. For your free copy, write Dept. RB-63.

OUTSTANDING ELECTRICAL PROPERTIES (black compound) for signal systems and service drop, wet or dry—at 50 megacycles and 25 deg. C. power factor is only 0.004; dielectric constant is 2.5. These values hold through the range from 60 cycles to 5 x 10^7 cycles. Operating temperatures up to 90 deg. C. have little effect on electrical properties. Insulation resistance is too high to measure on conventional testing devices. BAKELITE Polyethylene excels in resistance to voltage breakdown, even after long-continued water immersion.

BAKELITE TRADE-MARK
Polyethylene
WIRE COVERING

BAKELITE COMPANY, *A Division of Union Carbide and Carbon Corporation* UCC 30 East 42nd Street, New York 17, N.Y.
In Canada: Bakelite Company (Canada) Ltd., Belleville, Ontario

Kuhlman gives you



NEMA standards plus...

59 years experience building sturdy, reliable transformers

You can get a transformer that conforms to NEMA Standard almost anywhere. Transformer manufacturers conform to these standards, but you get certain "plus values" when you use Kuhlman power transformers. For instance, the Kuhlman Electric Company has been building transformers since 1894, shortly after the very first transformer was installed at Great Barrington, Massachusetts.

And for 59 years Kuhlman has been designing and building transformers to meet the requirements of utility and industrial users.

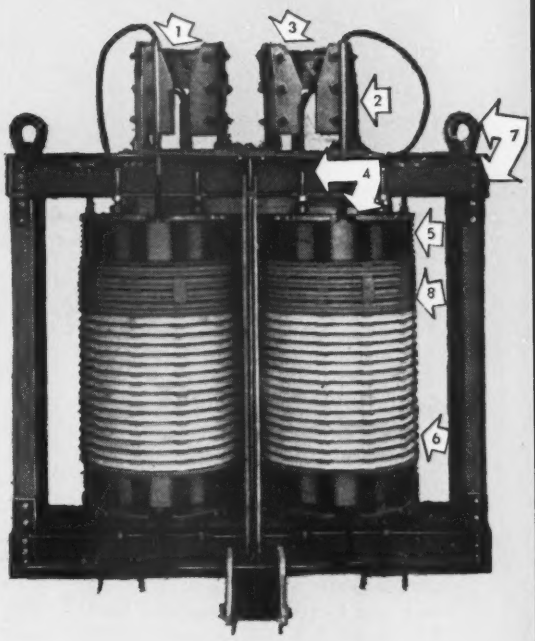
That's a lot of experience. It has resulted in power transformers that not only conform to the minimum NEMA requirements, but which have a high reputation for efficiency, reliability, and functional simplicity. Kuhlman engineers overlook no details in designing and building power transformers which will give you many years of efficient, dependable service. It is chiefly because of Kuhlman's use of approved and accepted design principles, carefully selected and tested materials, painstaking assembly, and thorough testing and inspection that you get a transformer of rigid, sturdy construction — the "plus value" which is the result of 59 years' experience.

The structural steel core clamps, which secure the core-and-coil assembly and anchor it to the tank, are the main source of sturdiness in Kuhlman power transformers.

Lock spacers, inserted between the coil sections, increase the strength of the coil and add to the over-all sturdiness of the transformer.

The tank is made from heavy steel plate. All cooling tubes and seams are electrically welded, providing oil-tight and rust-proof joints. The surfaces are shot-blasted and covered with a rust-inhibitive primer and two coats of corrosion-resistant paint.

Specify Kuhlman for your next transformer installation. Write us for the name of your nearest Kuhlman representative. And for further details about Kuhlman power transformers, ask for Bulletin CS-601.



CONSTRUCTION DETAILS

1. **Tap changer board — made of special heat resistant material developed by Kuhlman. Won't crack under high Class A insulation temperature.**
2. **Terminal board supports — made of grade A press board.**
3. **Fibre bolts — combine high electrical and mechanical strength.**
4. **Clamp jack screws and steel clamping plates — supply easily adjustable coil pressure top and bottom.**
5. **Porcelain blocking posts — offer increased creepage strength.**
6. **Lock spacers — firmly anchored between coil sections add to over-all construction strength.**
7. **Rigid core clamps with lifting lugs — provide mechanical strength and ease of handling.**
8. **Reinforced end coils — protect the transformer from surge potentials.**

Kuhlman

ELECTRIC COMPANY
BAY CITY, MICHIGAN
CRYSTAL SPRINGS, MISSISSIPPI

Export Representatives: *International Standard Electric Corporation,*
50 Church Street, 15th Floor, New York 4, New York
Cable address: Microphone, N. Y.

KUHLMAN K E ELECTRIC

129-A

TRAVELING FARM WORKSHOP, built in connection with Home and Farm Exposition, contains $1,500 worth of equipment and has been shown to thousands of farmers and students

Help Farmers Plan Home Workshop

In February 1951 the Alabama State Department of Education requested the Tennessee Valley Authority to assist in setting up two pilot farm workshops at selected vocational high schools. Similar shops are being planned by school officials throughout the TVA area and one portable farm shop was built for use with the Electrical Home and Farm Exposition. It has been used over the area for special demonstrations and a special series of demonstrations was arranged for Alabama, Tennessee and Virginia. It has been shown at the annual meetings of many co-ops.

To assist in demonstrations a pamphlet, "Planning the Home Farm Shop," was prepared. It tells the way of such shops, includes a drawing for a well-planned workshop and gives information on power equipment, tools, benches and uses of the equipment.

Safety Record Speeds Mercury Lamp Acceptance

Traffic accidents have been cut an average of 35% during the past five years by seven major American cities in those areas illuminated by mercury vapor lighting. This was disclosed in a survey conducted by the Jefferson Electric Co., Bellwood, Ill. The cities and the percentages of decrease are: Des Moines, 90%; Richmond, Ind., 47%; Dallas, 36%; Cheyenne, 34%; Denver, 18%; Reno, 15%; and Atlanta, 4%.

Jefferson's survey of 65 major U. S. cities in 28 states and the District of Columbia found that mercury vapor mileage today is nearly 16 times what it was in 1948 and 163 times what it was in 1943. None of the 65 cities had an increase in either accidents or crime in areas illuminated by mercury vapor lighting. Authorities responding estimated that the use of mercury vapor in their cities would increase an average of 50% in the next five years and more than 100% by 1963.

Westinghouse Develops Freezer Package Kit

Containing everything the homemaker needs for proper home freezing of foods in her freezer or refrigerator, a simplified, low-cost kit of wrapping materials now is available through Westinghouse appliance retailers. The kit, containing sufficient materials to package approximately 300 pounds of foods for freezing, carries a suggested retail price of $5.95. It is marketed under the name Westinghouse Sure-Wrap Freezer Kit. Included are a 50-foot roll of new and exclusive type of freezer foil, plus 173 polyethylene bags in assorted sizes, a marking pencil and 200 acetate closure bands.

What's Doing In Sales Activities

These briefs are intended to facilitate exchange of information among electric utilities on current, planned, and recent sales activities. For details on any activity, request should be made to the source of the particular brief. Your help in supplying material for this column will make it more meaningful.

"Lighting Lagniappe"—New Orleans Public Service, Inc, New Orleans, La. E. Avegno, manager, dealer relations. Annual light bulb campaign. A 150- or 200-watt bulb free with six others totalling 450 watts. Complete kit of point-of-sale materials for dealers features striking counter piece which holds required purchase and bonus bulbs.

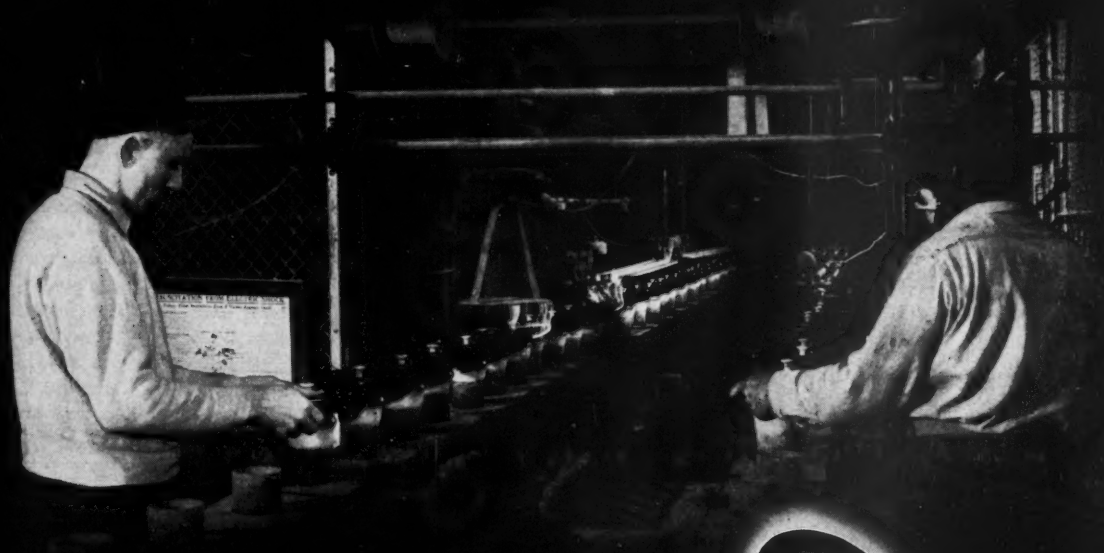
Water Systems Promotion—Union Electric Co. of Missouri, St. Louis, Mo. E. J. Gildehaus, rural service manager. Window posters for dealers, window displays in company offices, "Water Systems Day" meetings, feature stories in company publication distributed to rural customers, special editions of rural newspapers.

"Win a new electric range"—West Penn Power Co, Pittsburgh 30, Pa. J. E. Mueller, residential and commercial sales manager. Range promotion through dealers offering 12 awards of up to $350 each on purchase of range plus $50 awards to dealer salesmen who sell ranges to winning customers during contest period.

"Golden Opportunity"—Electrical Association of Philadelphia, Philadelphia 3, Pa. J. A. Morrison, managing director. Comprehensive and detailed analysis of sales opportunities for dealers. In 20 pages of presentation are shown size of market, income brackets, industrial devlopment, and saturations and potentials of 15 electrical appliances and services.

"Light Harmony"—Cincinnati Gas & Electric Co, J. R. Hartman, vice-president. TV home lighting promotion with music by Cincinnati Symphony Orchestra. Extensive publicity including prize contest, billboards, car cards and point-of-sale material for dealers.

VICTOR *PURIFIED PORCELAIN* SUSPENSIONS
RUN THE GAUNTLET TO GIVE YOU GREATER SERVICE



Victor No. 924 (25,000 lb.) Suspensions undergoing high frequency and 60-cycle flashover tests on Victor-designed continuous testing machine.

VICTOR NO. 924 (25,000 lb.) SUSPENSION

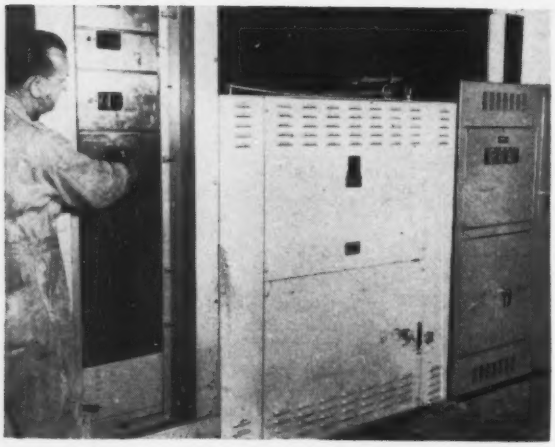
Every Victor Suspension Insulator has to "run the gauntlet" through the flashover testing machine illustrated here. And every one must stand up under both high-frequency and 60-cycle flashover for a period of more than three minutes before being eligible for shipment. This stringent, individual testing, coupled with the greater toughness, uniformity and resistance to impact of Victor *Purified Porcelain* gives greatest possible protection for your lines! More reasons why Victor is the power man's best buy! For full data on Victor Suspensions, write for Bulletin No. 4.

FREE BOOKLET gives you the full story on how Victor insulators are made—how and why *Purified Porcelain* was developed. Write us for your copy.

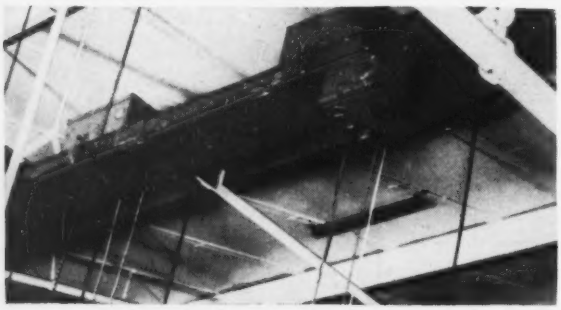
Specify VICTOR INSULATORS!

VICTOR INSULATORS, INC., VICTOR, N. Y.

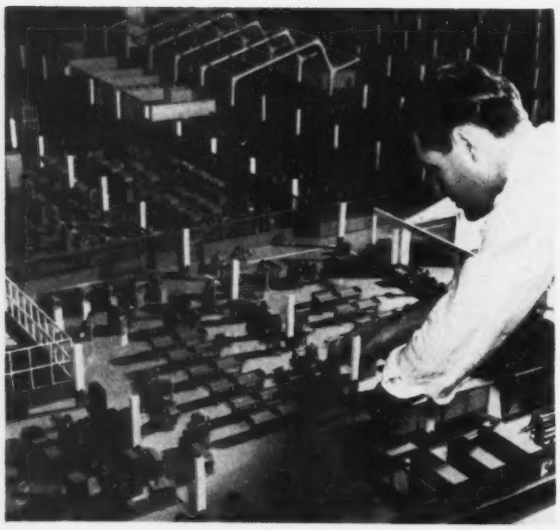
Low and High Voltage Pintypes • Suspensions • Guy Strains • Spools • Switch and Bus Insulators • Custom Designed Porcelain



UNIT SUBSTATION and load center located in plant area for power distribution. Thirteen of these units are located in plant area so that no point is further than 80 ft from any unit



BUS DUCT (2500 ft) installed over production lines expedites and facilitates changes in equipment during production change-overs. Rigid conduit is dropped from breakers to equipment



SCALE MODEL (½ in. to the foot) aids planning and eliminates trial and error method of placing machinery. When shift is made, whole movement can be planned and proved before actual change is made. Each machine, bench, cabinet, etc. is included

Load Centers and Bus Duct Provide Flexibility

L. B. REED, Industrial Heating Consultant, Dept of Water & Power, Los Angeles, Calif.

Installation of 2,500 ft of bus duct with load centers at strategic points throughout the 232,000-sq ft one-story main building of McCulloch Motors, Los Angeles, has provided the flexibility required for production lines which are changed as products change. The first cost of the bus duct was slightly higher than that of conventional distribution methods and equipment. But it permits quick and easy changes. Some machines are moved every three weeks, and the entire production line is changed about once a year.

Flexibility Needed . . . Naturally, re-arranging hundreds of machine tools in a short period would be impossible if conventional wiring methods, utilizing rigid conduit, were used. As it was known before the plant was built that there would be considerable shifting of machinery, bus duct was installed in rows over the proposed production lines. Machines are connected to this duct by plugging in breakers on top of the duct and dropping rigid conduit to the equipment.

By taking advantage of an option in the power rate schedule, which eliminates the necessity of segregating power and light, separate power and light feeders did not have to be run to each load center. This saved capital expense of some $50,000 and worthwhile amounts in monthly billing, according to Mike Eversz, plant engineer. Primary voltage is 34.5 kv, feeder voltage 4,160, and distribution voltage 240.

To provide good voltage throughout the one story main building, load centers, or unit substations, are installed at strategic points with no point more than 80 ft from a load center.

Scale Model Used . . . The company found it took considerable planning and maneuvering every time it changed from one product to another. To ease the pain of planning and eliminate the trial and error of placing machinery, a detailed, accurate, scale model of the plant was made, including each machine, vehicle, bench, and filing cabinet, on a scale of ½ in. to the foot. Now before a shift is made, the whole movement is planned and proved before the actual change is made. New locations of machinery are known to have access to necessary services and conveyor lines, and clearances are known to be sufficient because scale vehicles have been actually maneuvered through the new scale lines. Thus, changes are completed with a minimum of confusion and wasted time.

POWER

WHAT DO YOU THINK IS THE FULL "POWER" OF ALUMINUM CONDUCTOR?

Simply to conduct electricity efficiently?

Or do you agree with thousands of others in the industry that the "power" of aluminum conductor is *unlimited* . . . that it is more than just *another* material . . . that it has become the *basic* material for electric power systems!

You'll find the *full* "power" of aluminum conductor described on the following pages.

Kaiser Aluminum

THE POWER TO GIVE YOU BIG SAVINGS!

Every time you specify aluminum instead of copper you save money, because:

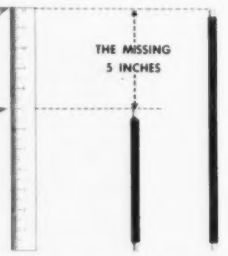
- Aluminum costs less than copper.
- Aluminum's light weight permits easier, faster stringing—cuts handling and installation costs.
- Aluminum's light weight reduces strain on house, pole, fittings—greatly reduces the cost of maintenance and repair.

Your total savings with aluminum conductor can be *as much as 35%!*

YOU GET THIS WITH ALUMINUM

ONLY THIS WITH COPPER

AT THE SAME PRICE!



For $.02705 you can buy a *full foot* of Kaiser Aluminum weatherproof (#4 Solid PE) compared to approximately 7 inches of copper (#6 TBWP) at the same price! In the chart at right note also the great differential in weight-strength ratio. Aluminum is much lighter, yet has strength for the most rugged service.

	Per 1000 Ft. Lbs.	Cost	Breaking Strength
#6 Solid Copper TBWP*	112	$ 46.73	960
#4 Solid Alum PE (2/64)	48	27.05	787
#2 7 Strand Copper TBWP*	270	111.70	2243
1/0 7 Strand Alum PE (4/64)	141	71.05	1864
2/0 7 Strand Copper TBWP*	522	204.99	4409
4/0 19 Strand Alum PE (4/64)	254	142.30	3889
4/0 7 Strand Copper TBWP*	800	312.56	6906
336400 CM, 19 Str. Alum PE (5/64)	404	232.75	5945

Sept. 1, 1953 prices based on 30,000#—F.O.B. Destination
*URC Copper Triple Braid Weatherproof

THE POWER TO GIVE YOU

BETTER DISTRIBUTION LINES!

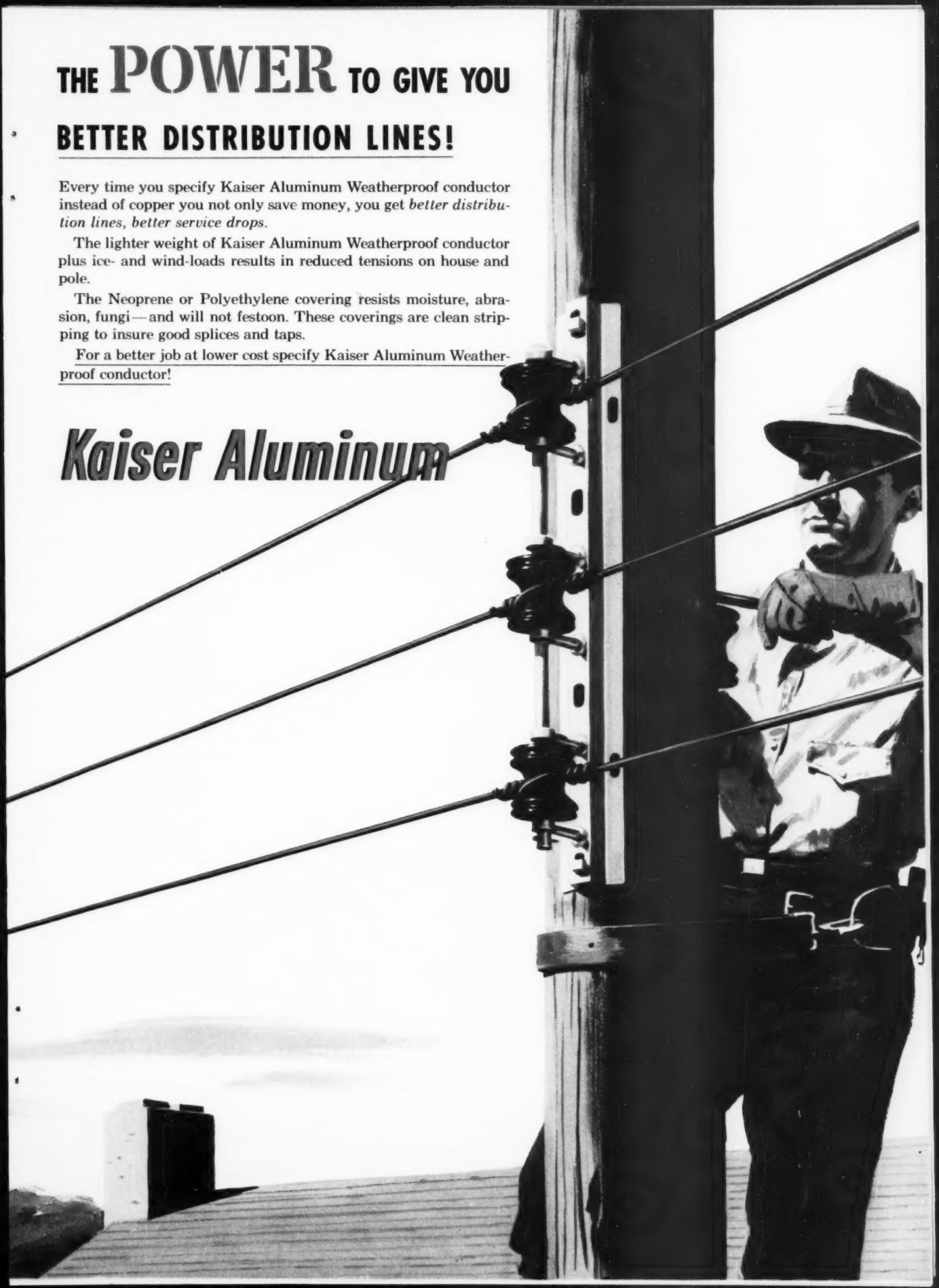
Every time you specify Kaiser Aluminum Weatherproof conductor instead of copper you not only save money, you get *better distribution lines, better service drops.*

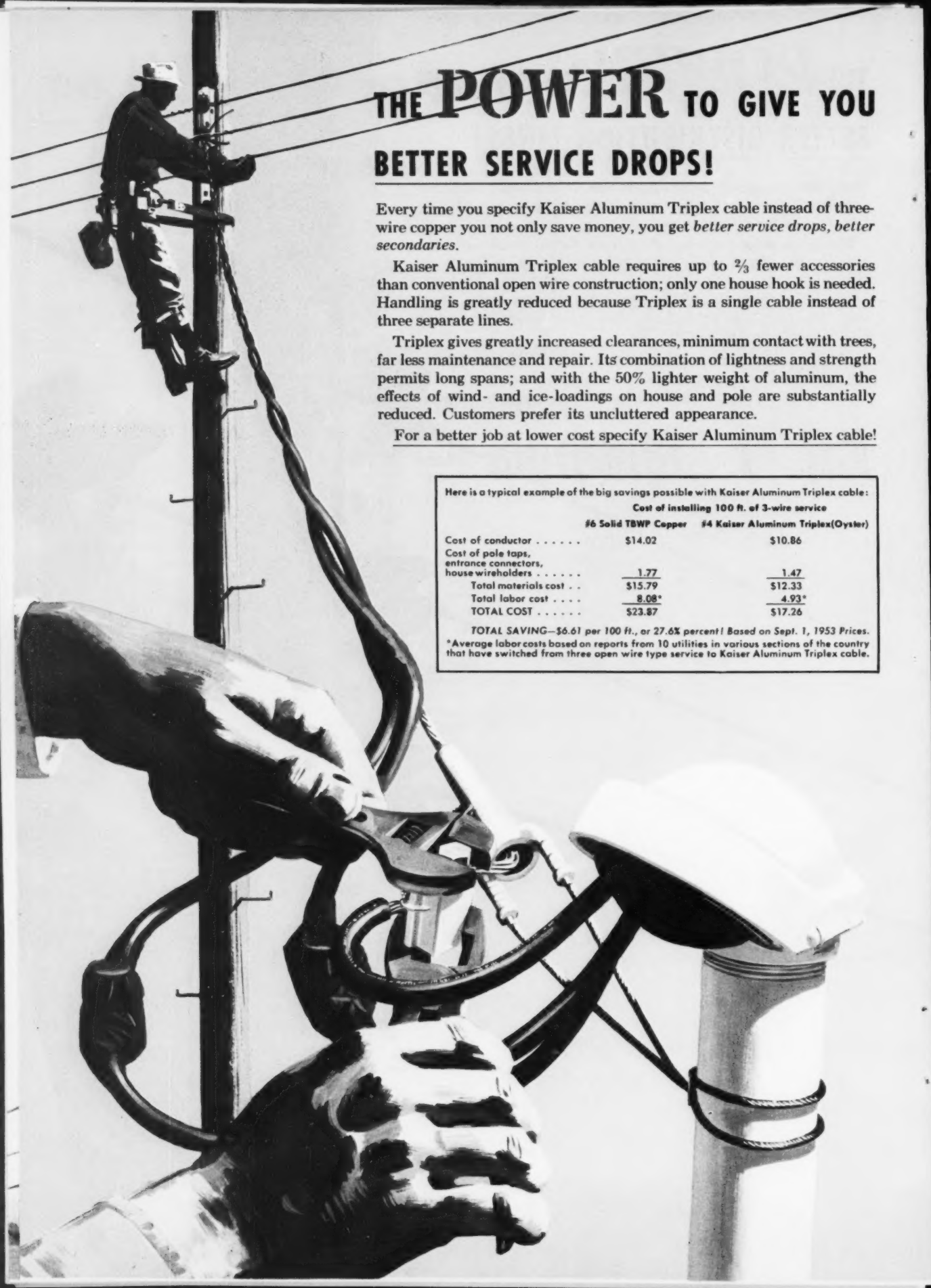
The lighter weight of Kaiser Aluminum Weatherproof conductor plus ice- and wind-loads results in reduced tensions on house and pole.

The Neoprene or Polyethylene covering resists moisture, abrasion, fungi—and will not festoon. These coverings are clean stripping to insure good splices and taps.

For a better job at lower cost specify Kaiser Aluminum Weatherproof conductor!

Kaiser Aluminum





THE POWER TO GIVE YOU BETTER SERVICE DROPS!

Every time you specify Kaiser Aluminum Triplex cable instead of three-wire copper you not only save money, you get *better service drops, better secondaries.*

Kaiser Aluminum Triplex cable requires up to ⅔ fewer accessories than conventional open wire construction; only one house hook is needed. Handling is greatly reduced because Triplex is a single cable instead of three separate lines.

Triplex gives greatly increased clearances, minimum contact with trees, far less maintenance and repair. Its combination of lightness and strength permits long spans; and with the 50% lighter weight of aluminum, the effects of wind- and ice-loadings on house and pole are substantially reduced. Customers prefer its uncluttered appearance.

For a better job at lower cost specify Kaiser Aluminum Triplex cable!

Here is a typical example of the big savings possible with Kaiser Aluminum Triplex cable:

	Cost of installing 100 ft. of 3-wire service	
	#6 Solid TBWP Copper	#4 Kaiser Aluminum Triplex(Oyster)
Cost of conductor	$14.02	$10.86
Cost of pole taps, entrance connectors, house wireholders	1.77	1.47
Total materials cost . .	$15.79	$12.33
Total labor cost	8.08*	4.93*
TOTAL COST	$23.87	$17.26

TOTAL SAVING—$6.61 per 100 ft., or 27.6% percent! Based on Sept. 1, 1953 Prices.

*Average labor costs based on reports from 10 utilities in various sections of the country that have switched from three open wire type service to Kaiser Aluminum Triplex cable.

THE POWER TO GIVE YOU

BETTER TRANSMISSION LINES!

Every time you specify Kaiser Aluminum ACSR instead of copper you not only save money, you get *better* transmission lines.

The combined lightness and strength of Kaiser Aluminum ACSR make possible longer spans. Fewer poles or towers are required. ACSR gives years of trouble-free service. Even after being subjected to severe ice- and wind-loads Kaiser Aluminum ACSR will usually return to normal sag without damage.

For a better job at lower cost specify Kaiser Aluminum ACSR and all-aluminum conductor!

THE POWER

Every time you specify Kaiser Aluminum conductor you benefit from complete and readily available services.

These Kaiser Aluminum services have helped countless others do a better job at lower cost—and they can do the same for you! For example, you get: →

TO GIVE YOU UNSURPASSED SERVICE!

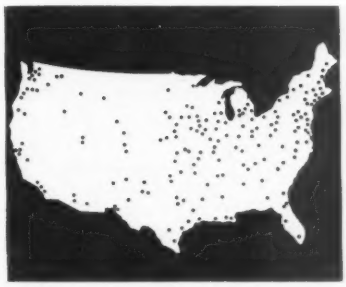
Field Service—Experienced Kaiser Aluminum field engineers are available to work with your crews on stringing jobs; demonstrate ways to speed installations and cut costs; make regular inspections during construction.

Engineering Service—Kaiser Aluminum engineers and specialists work with you in power system planning and design; furnish technical information such as stringing sag tables and sag-and-tension charts on request; help keep you up to date on latest construction techniques; help solve specific installation problems.

Laboratory Service—Kaiser Aluminum laboratories continually evaluate accessories, enabling us to suggest accessories and installation procedures designed to give you maximum service and economy. They offer assistance on phases of your operations involving fundamental research. They also continually check Kaiser Aluminum conductor to insure consistent high quality.

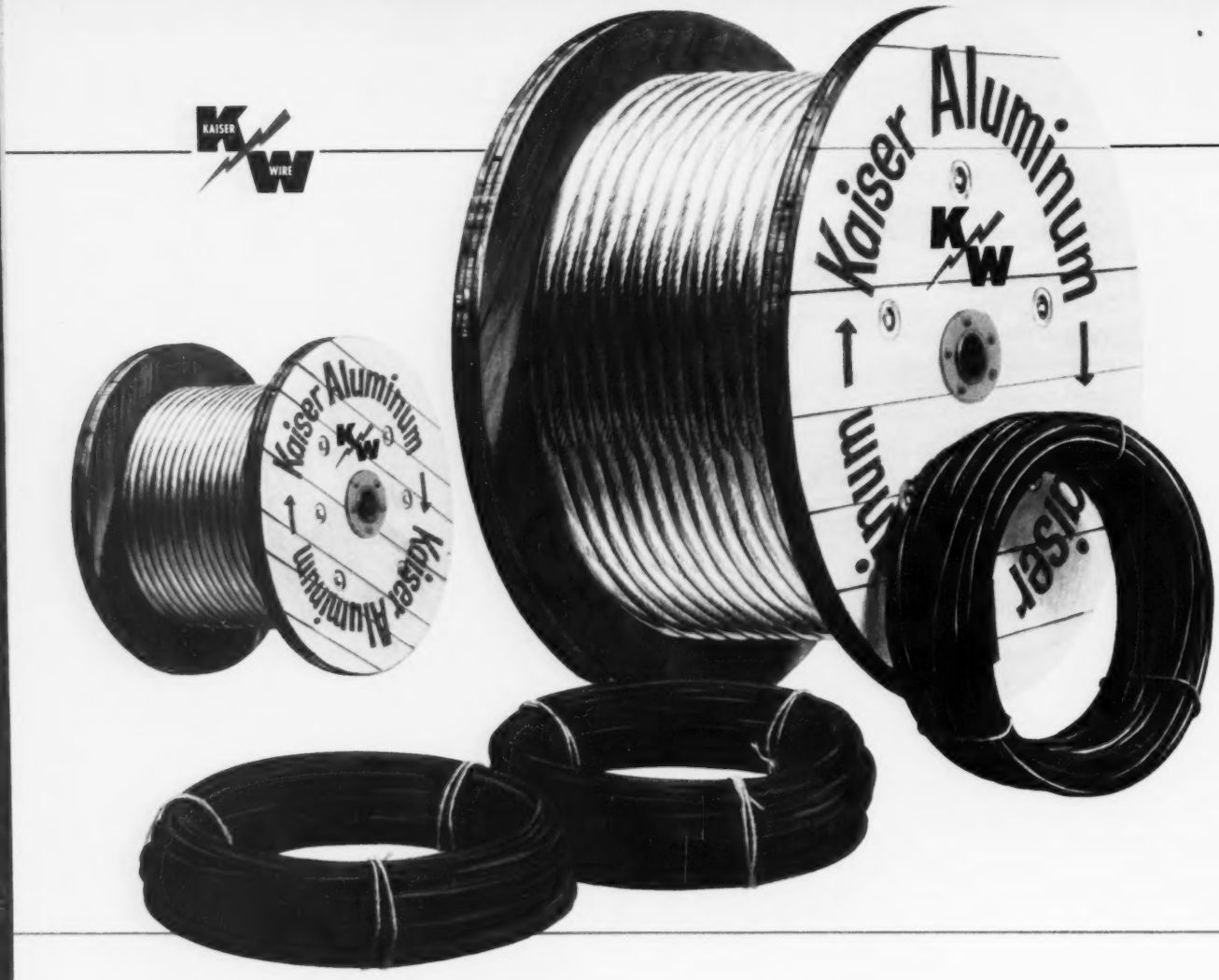
Delivery Service—Kaiser Aluminum's reputation for on-time delivery is unsurpassed in the industry.

You get these complete services at no extra cost when you specify Kaiser Aluminum conductor.



Kaiser Aluminum distributor coverage is the best in the country. There's a distributor conveniently located to serve you, wherever you are. His many services include: large stocks of Kaiser Aluminum conductor, fast delivery to help reduce your inventory, up-to-the-minute information to help keep you abreast of latest developments, friendly, personal attention on any size order.

Line Material Company
General Electric Supply Co.
Westinghouse Electric Supply Co.
Capital Electric Supply
Central Electric Supply Company, Inc.
Champion, Inc.
City Electric Distributors, Inc.
Crescent Electric Supply Company
Dauphin Electrical Supplies Company
Dutton-Lainson Company
Electrical & Mechanical Supply Corp.
Eoff Electric Company
Florida Electric Supply, Inc.
George H. Wahn Company
Hampden Electric Supply Company
Hunzicker Brothers
Interstate Electric Co. of Shreveport, Inc.
Maydwell & Hartzell, Inc.
Mine & Smelter Supply Company
Nelson Electric Supply Company
Price Electric Company
Russell Belden Electric Company
S. M. Supply Co., Inc.
Southern Minnesota Supply Company
Stuart C. Irby Company
Stubbs Electric Company
Tafel Electric & Supply Company
The Korsmeyer Company
Virginian Electric, Inc.
Waltrip Electric Company



THE POWER OF ALUMINUM IS A PROVED FACT!

It's a fact that aluminum is the basic material for your electrical power systems.
It's a fact that aluminum can greatly reduce your costs.
It's a fact that aluminum can give you better installations right down the line.
It's a fact that *you* should now take advantage of the full "power" of aluminum.

WHEN YOU GET ALL THE FACTS YOU'LL GET

Kaiser Aluminum

The Nation's Largest Producer of Aluminum Weatherproof Wire and Triplex

Act Now! For all the facts on why Kaiser Aluminum conductor and Kaiser Aluminum services are best for your operations call or write your local Kaiser Aluminum sales office listed in the classified telephone directory, or contact one of our many distributors.

KAISER ALUMINUM AND CHEMICAL SALES, INC., OAKLAND 12, CALIFORNIA

HEATING CABLE keeps concrete sidewalk free of snow and ice. Picture taken after snow storm shows effectiveness of installation

Electrically Heated Sidewalk Eliminates Snow Maintenance—Increases Safety

R L. CONBOY, Industrial Representative, Duquesne Light Co, Pittsburgh, Pa.

The installation of electric heating cable in a 5-ft wide sidewalk at the new John T. Ryan Memorial Laboratory of the Mine Safety Appliances Co, Pittsburgh, Pa. has eliminated all snow shoveling and ice chipping. The system operated very satisfactorily during last winter's snow storms. At the first sign of a snowflake or a freeze, the electric heat will keep this sidewalk in perfect condition.

In addition to eliminating the labor of cleaning snow and ice, the use of "electric melting" gives assurance that the sidewalk will be cleared completely and thoroughly. The company wanted to be sure that there would not even be a small bit of ice left on which a person might slip and fall, as might be the case with manual cleaning.

Now, it is not necessary to summon workers to shovel the snow if a snow storm occurs when maintenance personnel are not on the job, such as during the night or over week-ends. The watchman merely flips the switch and the sidewalk will be kept clear of snow and ice.

The installation is relatively simple. Electric heating cable was stapled to a wire mesh. The mesh was placed over the poured concrete about one inch below the surface and covered with a finish coat of concrete. The "cold-end" power leads were then brought out of the concrete through short piping to junction boxes.

Total load is 57.6 kw consisting of 72—160-ft sets of heating cable, each rated at 800 w. Wattage per square foot of sidewalk is 40.

INDUSTRIAL BRIEFS

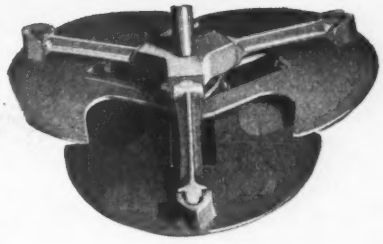
Space Heating with 4-1,000-w space heaters at colliery of Sandy Run Miners & Producers, Inc, eliminates freezing of water drippings from coal trucks—also snow between the scale and housing. Roland Edmunds, Industrial Representative, Luzerne Div, Pennsylvania Power & Light Co.

Moisture condensation in cold weather has been eliminated at Robertsville Brick Co., Robertsville, Ohio, by mounting 3-hp stack fans in stacks of clay drying tunnels. Green extruded clay ware is dried in tunnels heated with waste heat from cooling periodic kilns. A large fan pulls hot air from kilns (after fires are out), passes it through tunnels and out the stacks on far end. As tunnels are

The Old Reliable

EVERSTICK ANCHORS...

EXTRA Holding Power
QUICKLY Installed
TOUGH For long life



● They speed up work and provide dependable anchorage in new construction and maintenance. Quick and easy to install—made of tough rust-resistant malleable iron—their holding power "tops" all others. Available two-way, three-way, four-way, and cone types. Write for facts.

AN EXCLUSIVE
EVERSTICK
FEATURE
Exclusive Everstick nut housing. Locks anchor firmly on rod. No chance of rod slipping thru anchor.

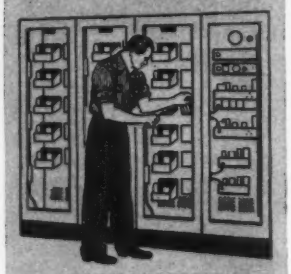
EVERSTICK ANCHOR CO.
Manufacturer of "THE ANCHOR OF MERIT"
FAIRFIELD, IOWA

GAI-TRONICS POWER PLANT COMMUNICATION SYSTEMS . . .

Prove that ENGINEERING and EXPERIENCE make the BIG difference!

CONSULTING

DESIGN AND ENGINEERING



FABRICATION

OPERATION

The *completely engineered* GAI-Tronics power plant communications system is designed and built by men associated with the design, construction, and operation of power plants throughout the world. Their "know-how" insures the solution to your power plant communication problems.

Two-way or group conversations can be carried on over telephone-type handsets and sound projectors *without* using special booths. The projectors can be used for paging and issuing emergency instructions. If you desire, telephone-like privacy may be had with the flick of a switch even though the system remains alerted for emergency use. The completely engineered GAI-Tronics system can be installed by *your* maintenance men. With a GAI-Tronics system, your power plant is equipped with a custom-designed, internal communication system that is easy to install; easy to operate; easy to maintain. A GAI-Tronics power plant communication specialist will be glad to discuss your communication problems.

GAI-TRONICS CORPORATION

READING, PA.

GAI FOUNDED 1906

A SUBSIDIARY OF GILBERT ASSOCIATES, INC.

FREE!

A booklet—Power Plant Communication Systems—or a convincing demonstration in your plant. The portable GAI-Tronics system designed by our engineers for this specific purpose can be scheduled for your plant upon request without obligation. Write today. Dept. G-T.

pressurized, hot, moist air previously leaked out around doors into factory proper with moisture condensing on men, material and machinery in cold weather. The stack fans have also increased the drying rate around 20%. G. W. Craiglow, Industrial Power Eng, Ohio Power Co, Canton.

Melting steel in a new top-charging electric arc furnace increased production capacity by 33⅓% and also reduced costs at the Hartford, Conn. Electric Steel Corp. Power input from a 2,000-kva water-cooled transformer equipped with motor-driven tap changers is controlled automatically by 2-unit motor-generators operating on current signals as small as 0.5 w for initial melting or refining. The furnace normally operates at about 8,000 amp, 150 v, 3 phase. Electrode location in relation to charge determines power input. Correct positioning means efficient use of furnace with low maintenance. About 535 kwhr per ton of steel is consumed.

Alloy melting has been given superior control in Turkish cymbal manufacture at Avedis Zildjian Co, No. Quincy, Mass., through the replacement of gas furnaces by two 100-kw high-frequency electric units. More accurate timing of the melt enables work to be done on an assured top quality basis.

Truck motor heating at the Hatch Transportation Co, Woods Cross, Utah has eliminated winter warm-up of 30 to 45 min. Company operates 11 diesel tank trucks. Each is provided with a 2.5-kw motor heater. In past winters drivers waited this period of time each cold morning while motors warmed up sufficiently. With heaters installed, motors now are heated ahead of time by the night watchman and trucks are ready to go when drivers arrive. Heaters can also be turned on by time-clock control if desired. R. M. Pizza, Utah Power & Light Co, Salt Lake City.

Heating oil at O. K. Coal, Inc, North Industry, Ohio (a coal washing plant) with a 5-kw electric immersion heater in a 40-gal tank provides spray nozzles with hot oil for treating coal after drying and eliminates dust losses. Heater raises oil temperature to around 230 to 250 F. A 4000-gal reserve tank feeds the smaller 40-gal tank. G. W. Craiglow, Ohio Power Co.

1000 MILES AT A GLANCE

You are looking at the Platte Pipeline Company's communications system. 1000 Miles of super-efficient microwave, surveyed, designed, manufactured and installed by *Philco* . . . world's leading manufacturer of microwave equipment.

The entire 1000 miles of this new microwave communications and control system can be seen in a glance at this terminal control board in Kansas City, Missouri. All functions of the pipeline can be observed and controlled at this point . . . The operation of pumps and compressors, the pressures and flow rates of oil, telegraphic printers, VHF mobile and stationary radio, even the operation of the microwave system itself.

Philco microwave provides complete communications and control for this giant pipeline with greater reliability and less maintenance cost than could be obtained from any other type of system.

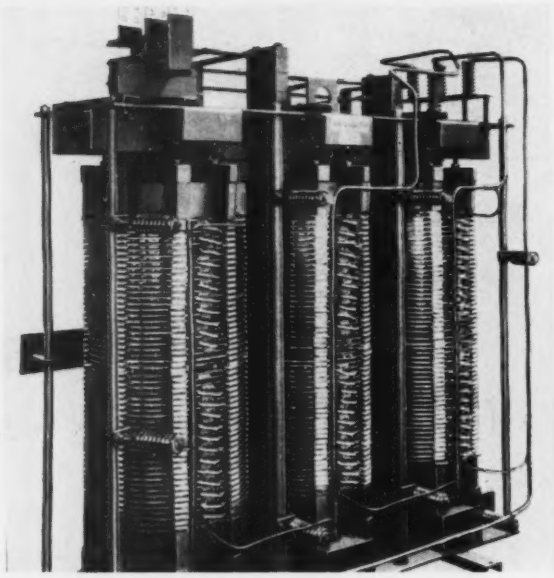
For Complete Information Write to Department ***EW***

PHILCO
Famous for
QUALITY
the World Over

PHILCO CORPORATION

GOVERNMENT & INDUSTRIAL DIVISION

PHILADELPHIA 44, PA.

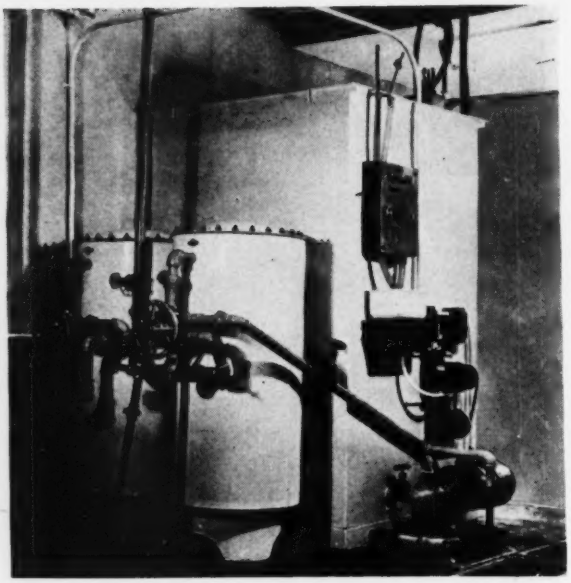


Dry-Type Transformer

A new line of dry-type transformers has been announced. They are designed to meet NEMA, ASA, and JIC standards. Adequate core and coil blocking, high-voltage insulators, and ventilated pancake coils are provided.

The core is designed to operate at moderate flux density to insure quiet operation. Coils are vacuum pressure impregnated with a high grade polymerizing varnish. Available either as a core and coil unit or in steel enclosures, transformers are rated up to 2,000 kva and 15,000 v.

Hevi Duty Electric Co, Milwaukee 1, Wis.

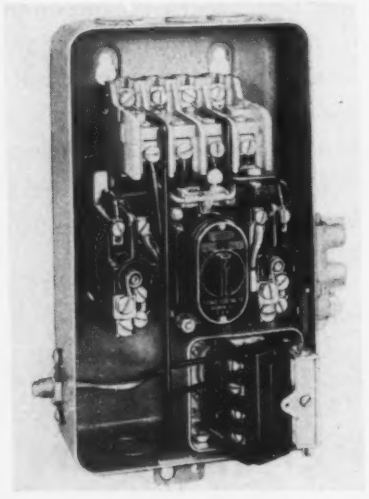


Water Conditioner

A line of water conditioners has been announced to remove turbidity, color, iron, manganese, and organic matter; chlorinate; and neutralize. They are available in eight sizes ranging from 500 to 3,300 gpm.

Conditioners consist of a precipitator with built-in clearwell, proportioning chemical feeder control, coagulant feeder tank, a lime or soda ash and hypochlorite feeder tank, inlet float control valve, Neutralite filter unit, Carbo-Dur purifier unit, and a service pump.

Permutit Co, New York 36, N. Y.

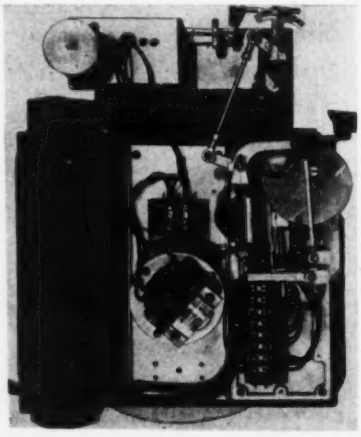


Magnetic Starter

A new, pressure operated, magnetic starter has been introduced. It combines a starter, pressure switch, and automatic unloader valve in a $6\frac{3}{8}$ x $10\frac{1}{4}$ x $4\frac{3}{16}$-in. enclosure. The units are available in three sizes up to 5 hp at 220-550 v single phase, or 10 hp at 440-550 v polyphase.

The pressure switch can be supplied in Series G with a capacity of 80 lb or Series H at a maximum of 200 lb. The package control is said to save wire, conduit, and labor at the time of installation.

Furnas Electric Co, Batavia, Ill.



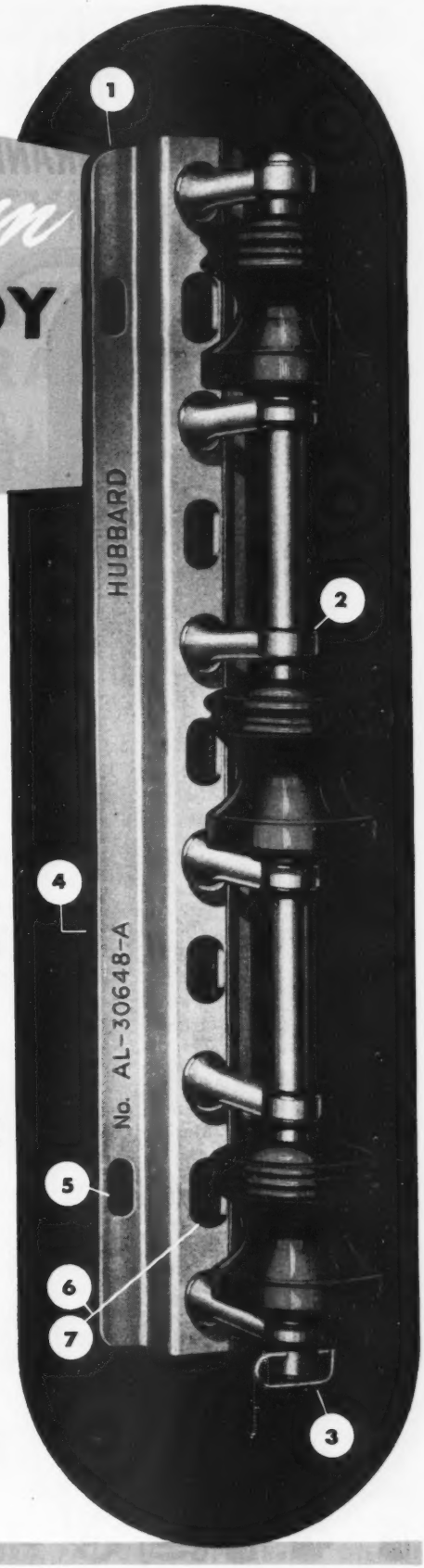
Flow Meter

A new electronic flow meter that makes use of mecury-less bellows-type transmitters has been announced. The meter is available in different models for indicating, recording, and flow measurement of fluids, such as steam and water. For the latter application a continuous-type mechanical integrator is used.

Differential pressure transmitter used with the meter are of metallic bellows, rupture-proof type for differentials of from 20 to 750 in. water with a static operating pressure of 1,500 psig. The meter is also applicable for liquid level measurement.

Introducing an

ALUMINUM ALLOY HUB-RAK



the FIRST major distribution product in pole line hardware made of wrought heat treated aluminum alloy

LONGEVITY... Greatly increased.

It is estimated by experts that the new Hubbard Aluminum Alloy Rack will outlast any other rack made, as determined by scientific laboratory tests.

STRENGTH... More than adequate.

Exhaustive tests have demonstrated that the new aluminum alloy rack meets or exceeds all strength requirements, past or present, that have been established for steel racks.

WEIGHT... about one-third of steel rack.

Only 2¾ pounds, less insulators, as compared to over 8 pounds.

CORROSION RESISTANT... to ANY atmospheric conditions.

The aluminum alloy from which these racks are made was chosen as the best from hundreds of formulae and has been thoroughly laboratory and field tested to withstand all atmospheric conditions.

APPEARANCE... New cleanliness maintained.

Bright new construction appearance is permanently maintained for the life of the line.

DESIGN FEATURES

1 Wrought, Heat Treated, Solid Aluminum Alloy.
2 Forged Solid Aluminum Alloy Points.
3 Solid Aluminum Link Type Cotter Key.
4 Aluminum Back shaped to form-fit the pole.
5 Side Mounting Slots 7/16" x 7/8".
6 Center Mounting Slots, 1 1/16" x 1¼" in line with conductors.
7 Can be mounted back to back on the same bolts.
Made to conform to E.E.I. Standards

HUBBARD AND COMPANY
ESTABLISHED 1843
PITTSBURGH • CHICAGO • OAKLAND, CALIFORNIA
"Hang the Load on Hubbard Hardware!"

HERE'S THE EXTINGUISHER YOU PICKED AS "EASIEST TO USE" OVER THREE OTHER LEADING BRANDS...

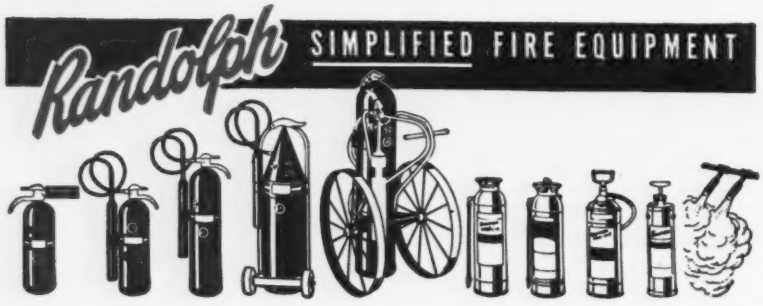
Randolph

Safety and Plant Engineers—here's how you voted: In a national survey recently completed, 100% of your replies stressed *ease of operation* as a major factor in Extinguisher selection. And on the basis of being "easiest to use", 86% of your replies specified Randolph over the nearest brand—66% specified Randolph over *three* other leading brands, *combined!*

With no nozzles to adjust, no valves to turn, Randolph Extinguishers are 100% panic-proof. Just snap from the bracket, aim and press the trigger. You KNOW how to use this extinguisher *just by looking at it!*

COMPLETE LINE OF EXTINGUISHERS AND AUTOMATIC EXTINGUISHING SYSTEMS

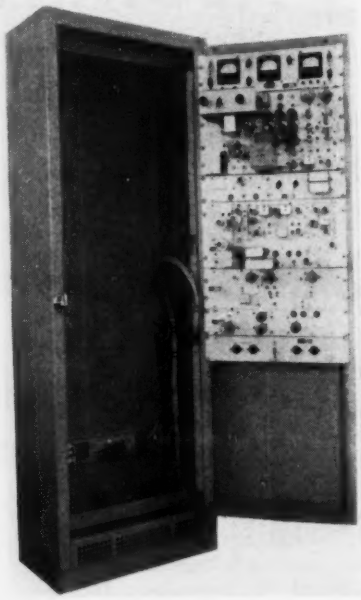
Make sure your plant is mobilized for fire . . . with easy to use, simplified RANDOLPH Equipment. Sizes from 2½ to 50 lbs. Manual and automatic systems. Write Randolph Laboratories, Inc., 12 E. Kinzie St., Chicago 11, Illinois.



Transmitter for this application is of the buoyant float-operated type with torque tube assembly.

Transmission system employed between the transmitter and recorder makes use of differential transformers and a null balance ac system. An electronic amplifier in the meter circuit assures good sensitivity and speed response.

Hays Corp, Michigan City, Ind.



Carrier Equipment

A new line of power-line carrier equipment, Type FD, for relaying, telemetering, supervisory control, and voice communication has recently been announced. Featured in the equipment is close channel spacing, said to be made possible by highly selective receiver filters and crystal control of frequency.

Frequency ranges are 40 to 90 and 90 to 200 kc. Assemblies operate from either station battery or alternating current.

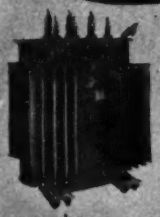
Westinghouse Electric Corp, Baltimore 3, Md.

Phase Sequence Meter

A simple and compact phase sequence indicator measuring approximately 7 x 2½ x 2½ in. and weighing approximately 1½ lb has been developed. It has no moving parts. To determine phase rotation the 18-in.

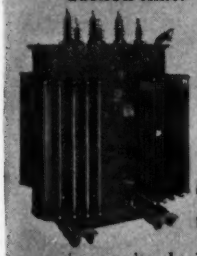
Today's best buy!

PENNSYLVANIA Standard Parts POWER TRANSFORMERS



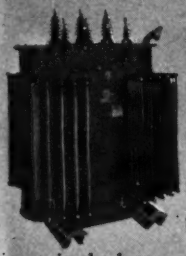
Faster deliveries are assured

when you order Pennsylvania Standard Parts Power Transformers. That's because quantity production methods of manufacturing, coupled with the use of standard designs and standard parts, shorten engineering and production time.



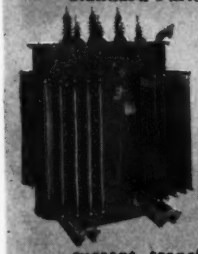
A wide range of optional voltages

is permitted with Pennsylvania Standard Parts Power Transformers, including 2 taps above and 2 taps below the primary voltage.



You have a choice of the method of oil preservation

in the larger ratings of Pennsylvania Standard Parts Power Transformers.



Optional equipment such as

current transformers, high voltage switches, etc., are available with Pennsylvania Standard Parts Power Transformers at regular prices, without any penalty being added to the base price of the transformer.

If your requirements call for power transformers in sizes up to 5,000 Kva, single phase, and 10,000 Kva, three phase — 69 Kv or less — then by all means find out about Pennsylvania Standard Parts Power Transformers. You will save up to 8% in capital investment, and get quicker deliveries. An example of this is the 2500 Kva, three phase Pennsylvania Standard Parts Power Transformer pictured above. This transformer cost the purchaser $1026.00 less because he specified Standard Parts.

Pennsylvania Transformer Company

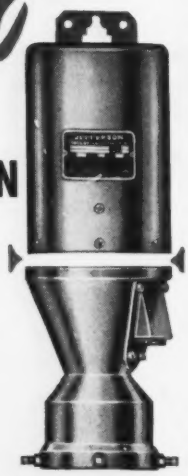
A McGRAW ELECTRIC COMPANY DIVISION

CANONSBURG, PA., Greater Pittsburgh District

FACTS PROVE JEFFERSON

Best of All

FOR MERCURY LAMP OPERATION



Jefferson Transformers are quickly converted to pole-top units by adding Jefferson patented universal adaptors.

Make Your Own Comparison—
Check the FACTS—Only
Jefferson has all the Vital Features

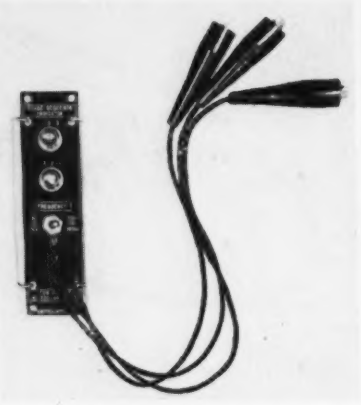
Nine *major* design and construction features *vital to top-flight transformer service, economy, and ideal lamp operation are listed below.* Modern *up-to-date* Jefferson Transformers incorporate *every one* of these features to give you *unmatched* value in every detail.

THE NINE MAJOR FEATURES	JEFFERSON TRANSFORMERS	Transformer A	Transformer B
1 Press-fit riveted core	YES	YES	NO
2 Leads stapled to core for positive strain relief	YES	NO	NO
3 Color coded and tagged leads	YES	NO	YES
4 Full sub-panel for rigid core and coil mounting with stamped lead designation	YES	YES	NO
5 Hot-dipped galvanizing on all outdoor types	YES	NO	NO
6 Deep Drawn cases on all outdoor types	YES	NO	NO
7 Solidly welded mounting bracket with locking holes plus key slot	YES	NO	NO
8 Universal Pole-Top Adaptor for 2½-4" O.D. Poles (a stock reducing feature)	YES	NO	NO
9 "Dura-Gray" harmonizing finish for modern, attractive installations	YES	NO	NO

For complete details and data on both outdoor and indoor type Jefferson Mercury Lamp Transformers, write for 16-page illustrated Bulletin 521-5. A copy is yours on request.

JEFFERSON ELECTRIC COMPANY
Bellwood, Illinois

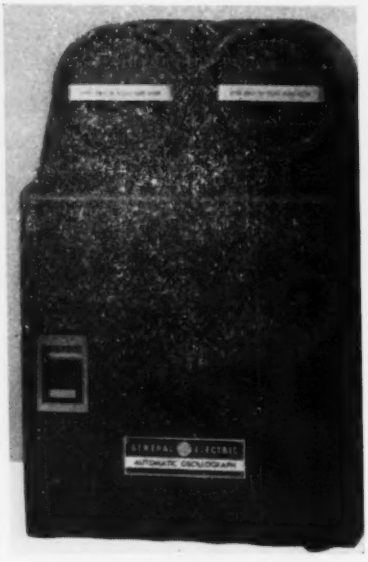
JEFFERSON ELECTRIC TRANSFORMERS



test leads are attached to power mains. One of the two lights will glow showing either 1-2-3 or 3-2-1 rotation.

The meter can be used on 110, 220, and 440-v lines without additional resistors. It will respond to a frequency range of 30 to 300 cps, and 300 to 1,000 cps at the flip of a switch.

United Manufacturing Co, Hamden, Conn.



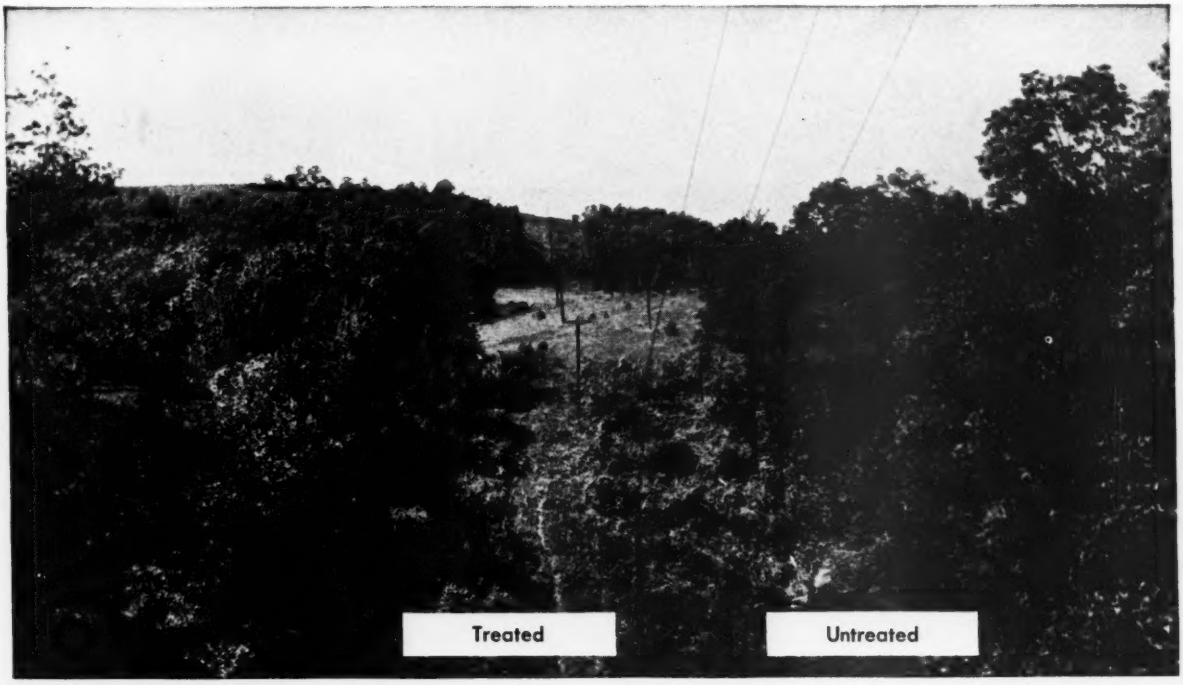
Oscillograph

A new seven-element automatic oscillograph for recording power system disturbances was recently announced. The Type PM-13 has seven permanent magnet, fluid-damped galvanometers with a separate shunt and resistor unit for current or voltage measurements. Controls are provided for starting the instrument automatically by overcurrent in ¼ cycle, and stopping it after a predetermined

DOW

DOW PRODUCTS GIVE SIMPLIFIED ECONOMICAL VEGETATION CONTROL

ESTERON BRUSH KILLER • ESTERON 245 • ESTERON TEN-TEN and DOW SODIUM TCA 90% aid right-of-way maintenance



When maintenance men and spray service organizations think of chemical brush control along power and communication lines, they think first of Esteron® Brush Killer. Dow research and manufacturing experience have gone all-out to make it the best product in its field. Research like this improves know-how for Dow as well as for manufacturers of special-purpose spray equipment, and for persons responsible for selecting chemicals for vegetation control.

Esteron Brush Killer contains the highly effective, low-volatility propylene glycol butyl ether esters of 2,4-D and 2,4,5-T. It controls alder, ash, birch, brambles, cherry, elm, hickory, maple, oaks, osage orange, poison ivy, sumac, willow and many other kinds of brush and trees. For certain 2,4-D resistant species, use Esteron 245 containing low-volatility esters of 2,4,5-T only. For deep-rooted perennial weeds, use Esteron Ten-Ten, new low-volatility 2,4-D ester weed killer. For grass control, use Dow Sodium TCA 90% alone or combined with Dow brush killers.

You are invited to look to Dow for a complete line of vegetation control chemicals. A wealth of technical information and assistance is yours on request. THE DOW CHEMICAL COMPANY, Agricultural Chemical Department, Midland, Michigan. In Canada: Dow Chemical of Canada, Limited, Toronto, Canada.

you can depend on DOW AGRICULTURAL CHEMICALS

DOW

save TIME and MONEY with a YORK-HOOVER Two-Man Crew Line Body

MODEL 5000 WD

Here is a brand new—Two Man—Line Body by York-Hoover offering a completely new conception of performance.

Built by a manufacturer with 61 years experience in the public utility field it presents many practical outstanding advantages.

Its rugged, all steel construction assures long life, and its carrying and storage capacity for tools and materials used in line work is ample.

All hole drilling and pole setting is done from the front, in full view of the operator affording greater speed and safety.

In conjunction with pole digging and derrick equipment, a hole can be drilled and a pole set in a matter of minutes.

Everything necessary to do the job is available in one package—all you do is supply a conventional chassis with a CA dimension of from 52" to 60".

Save TIME and MONEY with this up-to-the-minute Model 5000 WD unit.

Write for Bulletin No. 931 today!

York-Hoover Corporation
YORK, PENNSYLVANIA
Body Division

interval or after the fault has cleared.

Record chart is bromide paper, 4½ in. by 200 ft, and moves at a speed of 12 in. per min. A photographic time recorder establishes the date and time to the minute of each oscillogram. Including this recorder, the oscillograph measures 16 x 23 7/16 x 10¾ and weighs 95 lb.

General Electric Co, Schenectady 5, N. Y.

Safety Snap

A new safety snap for use with safety straps has been announced. It is claimed to completely eliminate the hazards of roll-outs and hang-ups without any special operations or extra gadgets.

Miller Equipment Co, Inc, Franklin, Pa.

Safety Switches

A new line of NEMA XII safety switches has been announced. They have a box formed and welded from heavy gage steel. The cover is sealed by a neoprene gasket, and is held

(*Continued on page* 196)

AIR CONDITIONED!

it's cool inside

GUTH

PEERLITE

Trademark

Permits flexible pattern planning. You can form any design you wish. For 2, 3, or 4 lamps — 4′ or 8′ long.

more cooling less cleaning

Wide open on top and bottom for brisk air-circulation

Cool lamps last longer.
Clean lamps stay brighter.
Clean fixtures give more light!

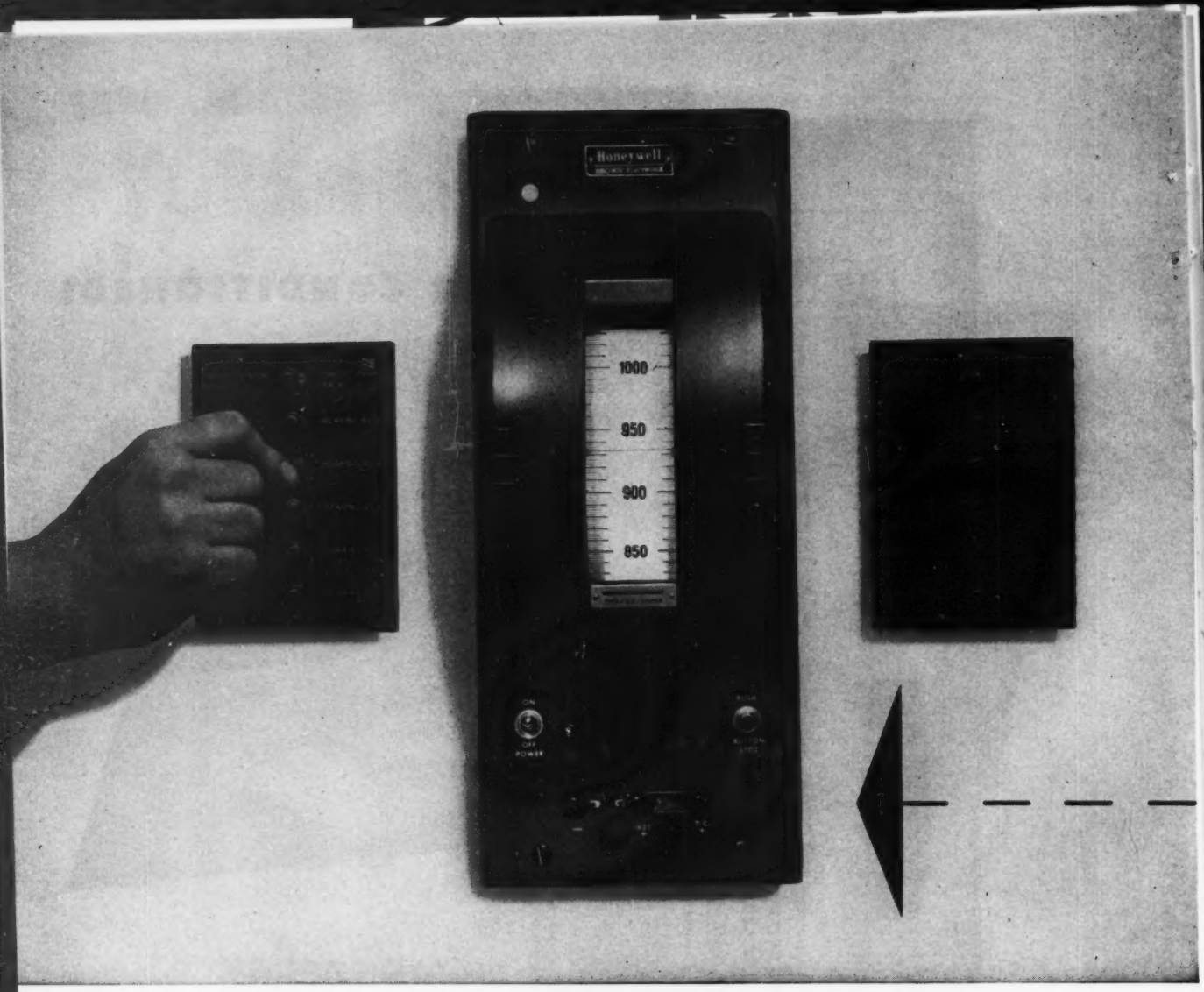
RESULT: greater efficiency
less maintenance
long-lasting beauty

*U. S. & Can. Pats. Pend.
Trademark registered

Write on your letterhead today for Catalog 911-H.

THE EDWIN F. GUTH COMPANY ST. LOUIS 3, MO.

Leaders in Lighting since 1902



Look at these features!

compact case
approximately 6½ inches wide by 15⅜ inches high

easily-read drum scale
rotates vertically; graduated length 28⅝ inches provides big, legible scale divisions and numerals.

accurate hairline index
eliminates parallax errors, permits high readability.

fast measurement
full scale rotation in 4½ or 12 seconds for 60-cycle operation.

external key switches
can be located at the side of the indicator (as shown), below or above—wherever most convenient for the particular panel layout.

large number of points
additional key switch banks provide any desired number of temperature points. Legend plates facilitate identification.

high precision
calibrated accuracy is 0.2% of scale span.

variety of ranges
supplied for use with either thermocouples or resistance thermometers, in a selection of ranges applicable to power plant temperatures.

Squeezed for panel space?

THIS NEW

Honeywell temperature indicator

needs no elbow room!

CROWDED PANELS are no problem for this new temperature instrument . . . the Vertical Scale Precision Indicator. Its slender, compact case makes it a natural for graphic panels—and a readily-inserted, space-saving member of conventional generator and turbine boards.

Basically, it's the same *ElectroniK* Precision Indicator which the power industry and many others have used and relied upon for many years. But, its outside appearance has changed: it's a completely new design that places the bulk of the instrument mechanism *behind* the panel . . . uses the valuable front-of-panel space primarily for the indicating scale.

Equipped with key switch banks, the Vertical Scale Precision Indicator offers a fast, convenient way to spot-check temperatures in bearings, pumps, hydraulic couplings, motors and other potential hot spots.

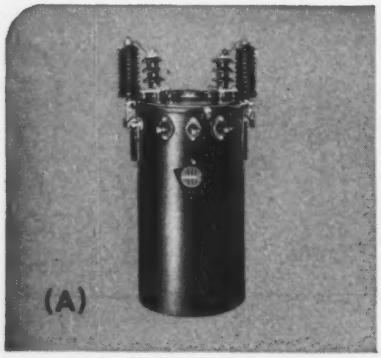
Your local Honeywell engineering representative will be glad to discuss how this new instrument can save space on the new panels which you may be planning. Call him today . . . he is as near as your phone.

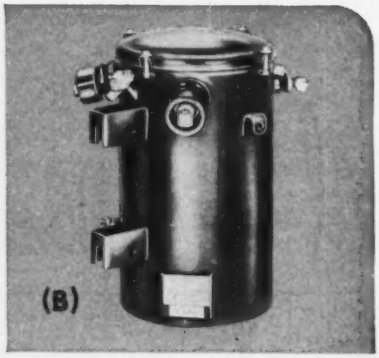
MINNEAPOLIS-HONEYWELL REGULATOR CO., *Industrial Division*, 4568 Wayne Ave., Philadelphia 44, Pa.

● **REFERENCE DATA: Write for new Bulletin No. 1541 on the Vertical Scale Precision Indicator.**

MINNEAPOLIS
Honeywell
BROWN INSTRUMENTS
First in Controls

Transformer Manufacturers Know oil oxidation problems...

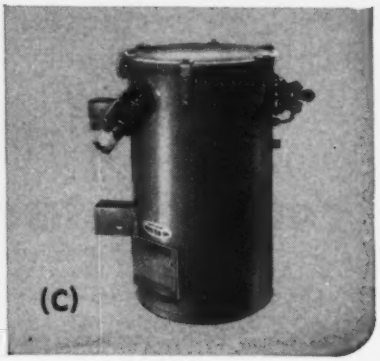

(A)


(B)

(A) Line Material Co.

(B) RT&E Co.

(C) Allis-Chalmers Manufacturing Co.


(C)

and they use DBPC!

• Leading manufacturers have proved by exhaustive tests the need for an inhibitor to protect transformer oil from oxidation and sludge. So they sell their transformers already protected—with DBPC inhibited oil.

DBPC Oxidation Inhibitor is placed in the transformers at the time of manufacture, and its constant use is advised from then on. DBPC keeps peroxide formation within the transformer to a minimum, and retards sludge formation. Because it lengthens the oil life, DBPC reduces oil cost and drastically cuts transformer maintenance costs.

Practically all of the transformer manufacturers in the country have adopted the use of inhibited oil in distribution transformers.

Most major oil suppliers advocate inhibiting, and will supply new inhibited oil upon request. So when you buy transformer oil, or reclaim used oil, insist that it be inhibited with DBPC—for the life of your transformer. If you wish additional information on DBPC, write to:

KOPPERS®

Koppers Chemicals

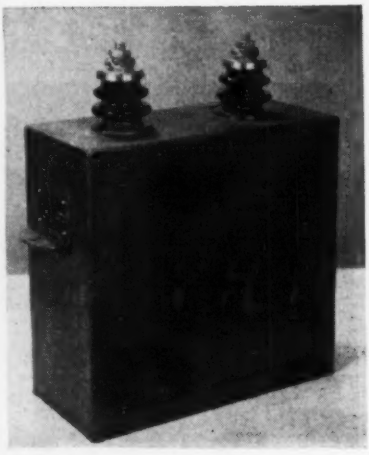
KOPPERS COMPANY, INC.

Chemical Division, Dept. EW-1093, Pittsburgh 19, Pennsylvania

closed by a latch and captive screws. A full cover and operating mechanism interlock is also featured.

External mounting feet eliminate mounting holes. No conduit openings or knockouts are provided. Switch and mechanism have heavy duty visible blades with magnetic blowout plates, non-tracking insulation, heavy silver plated copper parts, and pressure fuse clips. Switches available are rated 30, 60, 100 and 200 amp, in either 240 v ac/250 v or 600 v ac/dc.

Square D Co, Detroit 11, Mich.



Capacitors

A 15-kvar, 230-v capacitor has been announced. It can be supplied in three styles: three-phase indoor, single-phase outdoor, and three-phase outdoor. Units may be mounted in 1, 2, and 4-unit pole brackets or in indoor dust-tight and rack-type equipment. They weigh 76 lb and measure 6 x 17½ x 17 in.

Westinghouse Electric Corp, Pittsburgh 30, Pa.

Gas Sampling Pump

A new gas sampling pump for use with gas analyzing equipment has been announced. It features a design in which gas does not contact metal, and there are no stuffing boxes and shaft seals. Therefore, there is no possibility of either contaminating the gas or leakage of gas from the pump, it is claimed.

The pump has an eccentric shaft and rotor assembly which rotates inside and actuates a durable precision

Simple as 1-2-3 to Install...

FARGO

"VISE TYPE" CONNECTORS

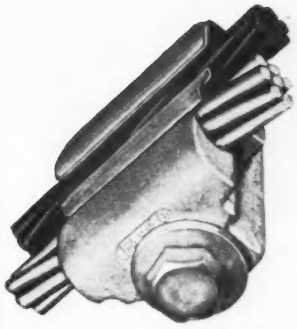
THE "5000 SERIES" FOR COPPER CONNECTIONS: This is Fargo's Standard Connector—obtainable in bronze or plated bronze. Vise-type design and one-piece construction make installations fast and easy. Available for #8 sol. to, 1000 MCM.

THE "7000 SERIES" HEAVY-DUTY CONNECTOR: This series is designed with a heavy spacer bar and wide contact areas of bronze, aluminum, or aluminum with bimetal inserts for "like metal" contact. Available for #6 sol. to 1,000 MCM.

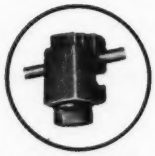
THE "9000 SERIES" FOR ALUMINUM-TO-ALUMINUM OR ALUMINUM-TO-COPPER: Available in 4 types; type 1—for aluminum-to-aluminum—and type 2—for aluminum to copper—are used for smaller wire sizes, up to and including 4 ACSR. Type 3—for aluminum-to-aluminum—and type 4—for aluminum to copper—are used for large wire sizes, above 4 ACSR.

THE "5000 SERIES"

THE "7000 SERIES"



THE "9000 SERIES"



1st. HOOK ON RUN

2nd. INSERT TAP

3rd. TIGHTEN BOLT

FARGO

Manufactured by

FARGO MFG. COMPANY, INC.

Poughkeepsie, N.Y.

Distributed by

LINE MATERIAL COMPANY

(A McGraw Electric Company Division)

Milwaukee, Wisconsin

KLEIN

equipment you can rely on

Talk to any old-timer on the job and he'll tell you Klein equipment is his choice for comfort—for safety—for service. Look for the familiar Klein trade-mark on pliers, safety straps and belts, climbers, grips and wrenches. Klein has been serving the electrical industry "Since 1857."

ASK YOUR SUPPLIER

Foreign Distributor: International Standard Electric Corp., New York

Write for your free copy of the Klein Pocket Tool Guide today!

"Since 1857"

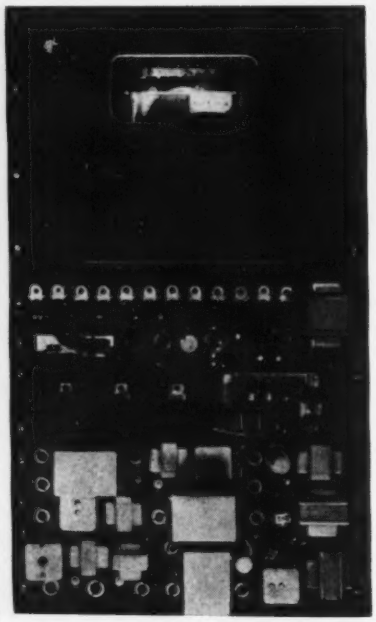
Mathias KLEIN & Sons
Established 1857
Chicago, Ill., U.S.A.
1200 BELMONT AVE CHICAGO 18 ILL

molded flexible liner. Gas that is trapped on the outer surface of the liner and inner surface of the body block is "squeezed through the pump. Molded flanges on the liner are pressed to both sides of the body block by end plates to seal off the fluid passage from contact with moving parts.

Body block is available in Polyethylene, Bakelite, and high-temperature resistant Buna N hard rubber. Liner is available in gum rubber, natural rubber, Buna N, etc.

For continuous operation and where relatively high vacuums and discharge pressures are specified, a reservoir is placed directly above the discharge in the discharge line. The reservoir can be filled with any fluid that will not affect the gas sample. Use of oil reservoir enables capacities from 0 to 35,000 cc per min, with discharge pressures from 0 to 35 psi and suction lifts up to 22 in. Hg.

Vanton Pump Corp, New York 1, N. Y.



Control System

A remote control and telemetering system for unattended broadcast transmitters built to meet recently announced FCC regulations has been introduced. It consists of three sections.

One is a control panel with telemeter indicator, a dial telephone, and other controls for installation to the operator's console. A second section installed at the control point has a number of audio-frequency tone transmitters and receivers. The third installed at the remote broadcast transmitter consists of audio-frequency tone generators and selective amplifiers, the telemetering transmitter, the control selector, and alarm keying mechanism.

A single audio-frequency telephone circuit is required. VHF or microwave may be used. Full control is provided for up to nine separate circuits.

Hammarlund Manufacturing Co, Inc, New York 1, N. Y.

MORE NEW PRODUCTS

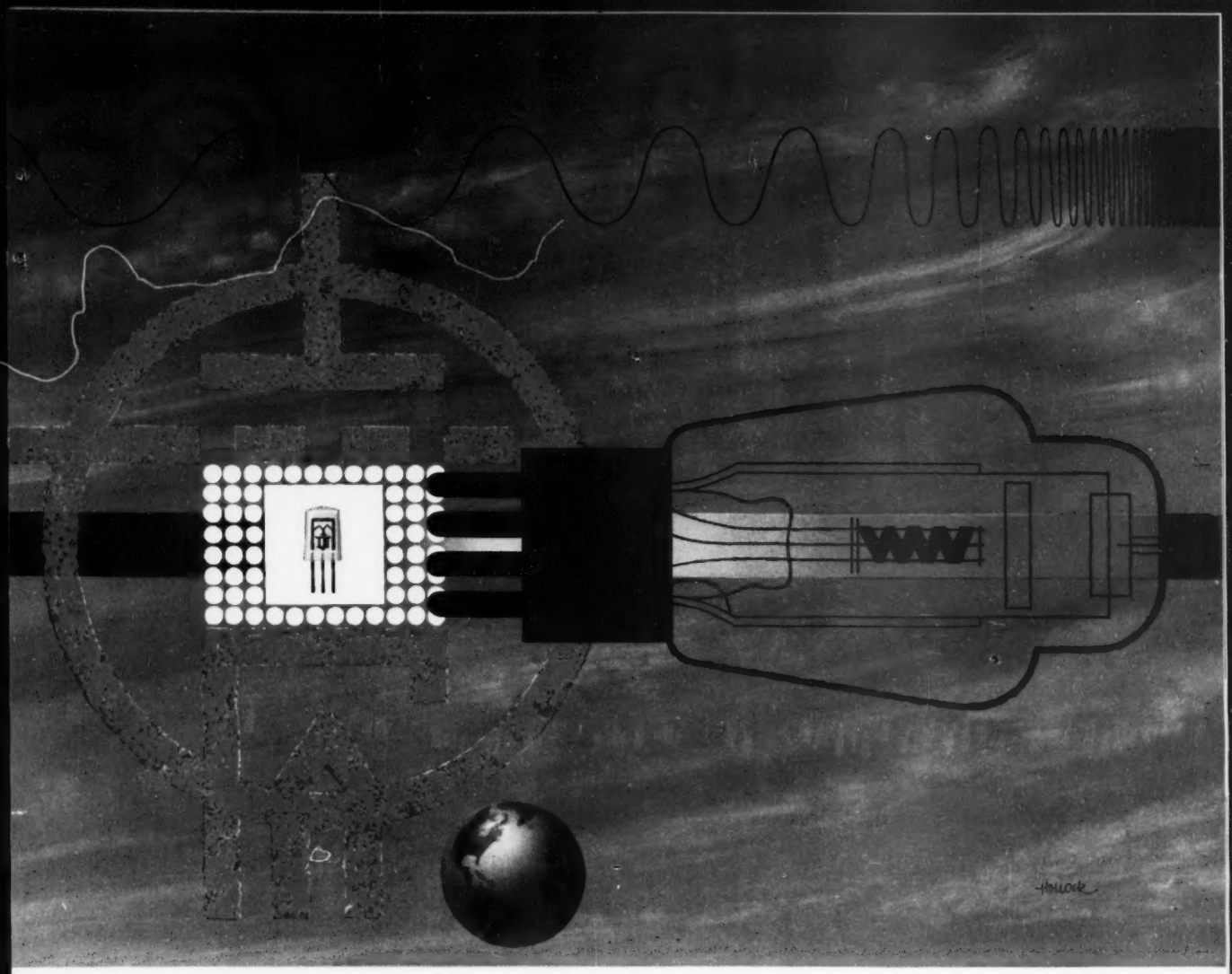
about which you should know

Glastic Corp, Cleveland 3, Ohio, announces a line of fiberglass **channel wedges** for Class B motor applications . . . J. H. Holan Corp, Cleveland, Ohio, has a new truck-mounted power operated **derrick** that is mounted on the rear of a truck.

Baron Industries, Los Angeles, Calif., announces a barrel-type **degreasing unit** that requires 5 gal of cleaning solvent for effective operation . . . Minneapolis-Honeywell Regulator Co, Philadelphia 44, Pa., has a **differential converter** for adding to a flow meter, which incorporates a pilot relay transmitter that reduces air consumption to a minimum.

Computer Research Corp, Hawthorne, Calif., announces an electronic **predetermining counter,** capable of counting up to 1,800,000 cycles per min without the use of vacuum tubes . . . D. W. Onan & Sons Inc, Minneapolis, Minn., has two gasoline-driven **electric plants** rated at 10 kw and 15 kw.

I-T-E Circuit Breaker Co, Philadelphia 30, Pa., announces a new thermal-magnetic **circuit breaker,** available in ratings from 70 to 225 amp, 2 and 3 pole, 600 v ac, 250 v dc, 15,000 amp interrupting . . . F. D. Kees Manufacturing Co, Beatrice, Nebr., has a meter **socket cincher** that simplifies meter socket installations.



Electronics . . . *and The National City Bank of New York*

Midget electronic marvel is making science-fiction stories come true

A tiny electronic device called the transistor has brought the magical world of robots much nearer than most people realize. No bigger than half a pea, this electronic marvel may make it practical for mechanical brains to run factories, operate inventory and warehouse control systems, read utility meters, make out bills, and perform other equally amazing feats.

The transistor does about the same work as a vacuum tube. But it takes up much less space, uses much less power, generates almost no heat, and lasts almost indefinitely. Consequently, it holds out the promise of smaller, lighter, more durable designs in electronic equipment like radio and television sets. It also extends the electronics frontier tremendously.

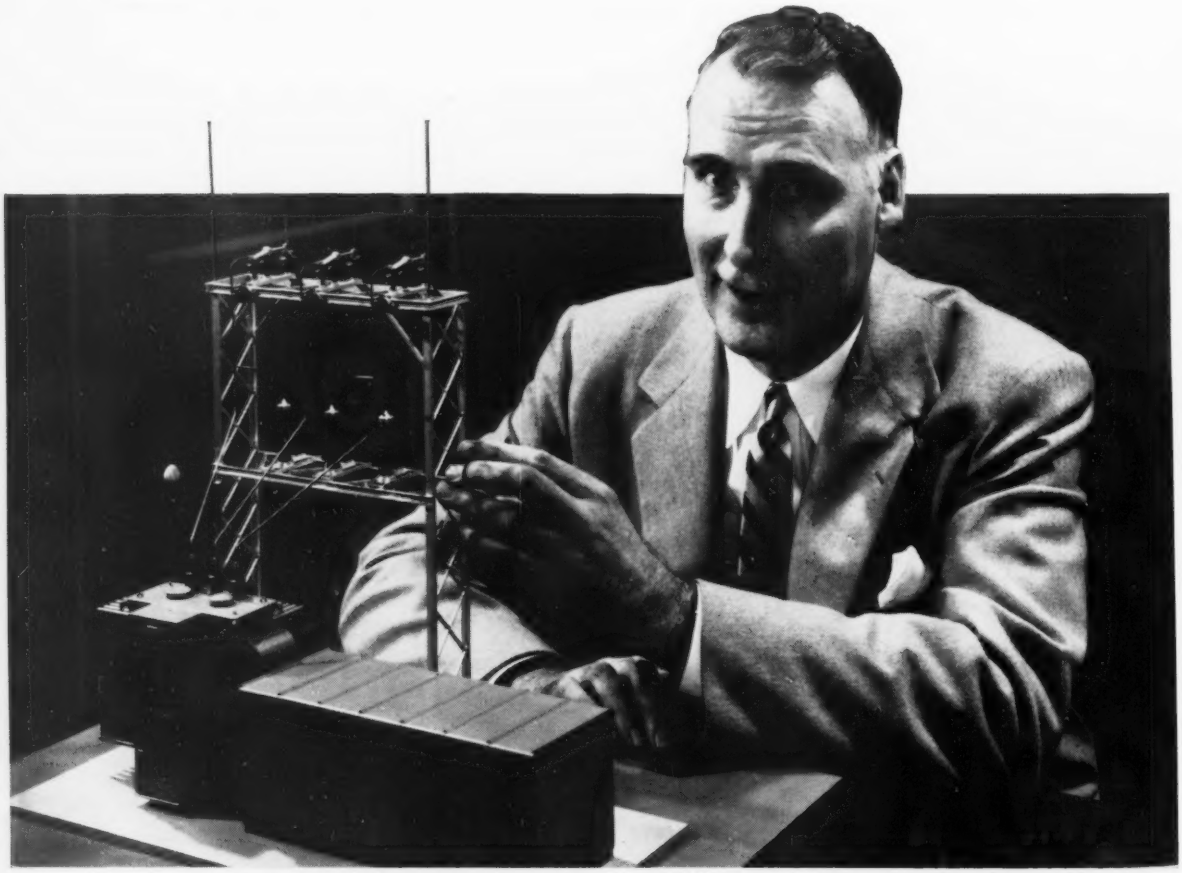
How rapidly that frontier has already been expanding may be gleaned from the fact that in 1939 total production of electronic equipment totaled about $300 million. Last year production was over $4.5 billion, and the total could reach more than $5 billion this year.

Like fast-growing companies in other fields, electronics manufacturers have found National City's $6 billion in resources, 141 years of experience, and world-wide banking facilities invaluable. Facilities include 57 Branches overseas, and correspondent banks in every commercially important city of the world. In this country, National City has correspondent banks in every state and 68 Branches in Greater New York. For help in solving your banking or financial problems, large or small, write

The National City Bank of New York, 55 Wall Street, New York City.

Member Federal Deposit Insurance Corporation

First in World Wide Banking



Substations with a future help protect your system investment

Wally Payne, Manager of Unit Equipment, explains why Westinghouse Coordinated Substations are fundamental to modern distribution systems: "they provide the flexibility vital to future changes in load requirements. They are the first step in assuring you the greatest return and long-time usefulness from your system investment."

The components of Westinghouse Coordinated Substations are engineered to work and fit together from the design stage, through manufacturing. Addition of a feeder is a simple matter of adding the compact switchgear unit. A transformer can be changed out readily when necessary. The load capability of the coordinated substation can be readily adapted to accommodate load growth and shifting load centers. An entire substation can be moved easily and economically—with a minimum of temporary disturbances to service and without sacrifice of protection.

Installation is simple. All you have to do is lay a foundation, throat-connect cubicles to the transformer, and tie in feeders. Savings in time and labor are substantial, compared with field-assembled equipment.

For full details on Westinghouse Coordinated Substations, call your Westinghouse Representative, or write for B-4061, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-60811-A

YOU CAN BE SURE...IF IT'S Westinghouse

LETTERS TO THE EDITOR

List Price Clarification

To the Editor:

Being an ardent reader of Electrical World, I have become quite an enthusiast of the material published. Occasionally I might take issue with some of the items and one in particular was printed in the July 6 "In the Industry" column headlined, "Appliance Sales Below List Prices." Unless practice has drastically changed from periods when I was a retailer, and also when I had considerable to do with purchasing, the article warrants some clarification.

List prices are arbitrarily affixed to merchandise by jobbers and wholesalers after cost and profit markup has been computed. Though frequently an addition for "list" does not exceed 30%, that figure is about minimum. In turn, a scaled discount is allowed the retailer or user, dependent upon who you are, the volume of purchase, etc. I have procured many items as a purchasing agent at a discount from list of 50% and 6% additional for cash. Furniture can usually be purchased at 40% plus cash credit; appliances seem to run around 30% from list. The retailer frequently establishes his own selling price.

Many merchants in the Los Angeles area, including some of the largest establishments, have been using these so-called "list prices" as their retail price for scarce or hard to get merchandise for as long a period as the market will stand up. Some use these continually unless a manufacturers "suggested retail price" is affixed to the article and such suggested selling price is nationally advertised.

Recently in shopping for one particular deep freeze for myself I was determined to place my business where the item was available for immediate delivery. We are having quite a plague of retailers taking orders for merchandise for immediate delivery from floor samples and not effecting delivery for weeks and even months. I contacted ten major appliance houses; seven of these would gladly order the item for me and all quoted the same "list price" as retail ($629.95). There were various extras or deletions suggested. The wholesale price of this freezer at the Midwest factory is $350.

The so-called discount houses—I hold membership in two of the largest in Southern California—quoted prices, but no delivery date, respectively, prices which are identical. It might be that the attitude of the public has become a necessity in dealing with the whims of "business principles and practice."

Milton M. Foster
Oxnard, California

Which Came First?

To the Editor:

In reading Philip Sporn's marvelously informing article in your issue of June 29 on the new work at Philo Station, I came across an omission which might lead the reader to draw an erroneous impression. It appears that the author unintentionally overlooked the priority attained by the Charles Leavitt Edgar Station of the Boston Edison Co in the installation of the 1,200-psi reheat unit at North Weymouth which went into operation in December, 1924, nearly six years ahead of Deepwater.

We are extremely proud of our participation with Irving E. Moultrop and his Boston Edison associates in this pioneer work, and would like to go on record to that effect while expressing our admiration for the contributions of Mr. Sporn and his associates in the field of advanced steam generating plant development.

W. F. Ryan,
Vice President
Stone & Webster Engineering Corp
Boston, Mass.

This Is Progress?

To the Editor:

Your editorial on the lack of basic progress in electric range design was never more vividly brought out than while reviewing the kitchen story exhibit in the huge Henry Ford Museum in Dearborn, Mich. recently.

The similarity between the old and the new was simply amazing! About the only changes one could note were in appearance—not function—as brought about through availability of new materials and finishes; today's stove is white instead of black. To illustrate:

1. The basic blocky space-consuming bulk is still there—except the corners are now square instead of mid-Victorian curves.

2. The oven is still down in the same grunt and groan location—and when open still extrudes a hot door in your way.

3. The fancy cost ornamentation of yesterday is still with us in the multicolored mess we today call a control panel.

4. And the most important similarity is we still, in this day and age, use two mediums to cook our edibles—a medium to generate heat (be it wood, coal, electricity, or corn cobs) and another inefficient medium (the unchanged pots and pans) to absorb this heat and then re-transmit it to the food.

One can't help thinking: What a fertile field for some really imaginative thinking, some engineering research; in short—some progress!

John W. LaLonde
West Allis, Wisconsin

On the Wrong Burner

To the Editor

Your "Electrical Week" section in the Sept. 21 issue, page 117, included the following paragraph:

"Among new developments unveiled there [at the I.E.S. National Technical Conference] was the first 1,550-w infrared lamp to be used as a top burner on an electric range."

We look to Electrical World as being the outstanding magazine for the electric utility industry, and it is, therefore, with great disappointment that we find the word "burner" so prominently displayed. We naturally think of burner being descriptive of oil and gas equipment.

Electricity is not a fuel which burns, and I thought that we were trying to educate the people in our industry so that they would use the expression, "surface unit or element," to distinguish our source of heat as separate from others.

Therefore, you can see why we have a feeling of being let down when our magazine uses an expression more commonly used by our competitors.

E. L. Huse
Jersey Central Power & Light Co
Morristown, N. J.

Preformed ARMOR RODS

Applied with a *TWIST of the wrist!*

Save Time, Labor

● **Preformed Armor Rods** are quickly and easily applied *by hand.* Their preformed spiral pitch tightly grips the conductor for a perfect, lasting fit. No special tools, clamps or clips are needed. By reinforcing the conductor at the supports, **Preformed Armor Rods** minimize breaks due to vibration fatigue. They also protect against flashovers and arcing, provide increased holding power, prevent abrasion and chafing, eliminate tie and clamp damage, increase radiation area and reduce corona losses. Designed and produced to accurate standards in Aluminum Alloy, Galvanized Steel, Bronze and Copperweld.

Preformed Aluminum Alloy Line-Guards

● Provide protection against wear and abrasion, especially where insulated wires pass through trees. Designed for use with self-supporting service-drop cable . . . also available for covered single conductors. *Ask your Graybar representative for details!*

INDIANA STEEL & WIRE CO.
Muncie, Indiana

WHAT THEY'RE SAYING

At Industry Meetings

Canada Has Bright Electrical Future

ROBERT H. WINTERS, Canadian minister of public works, at fall banquet of the American Society of Mechanical Engineers, Rochester, N. Y.

Canadians already use almost twice as much electric power per capita as Americans do, and it is developed and utilized at about half the cost per kilowatt hour. With less than 1% of the world's population in Canada, we develop over 10% of the world's hydroelectric energy. Even so, we are not yet using a quarter of our known potential.

During the 12 years following the outbreak of World War II Canada's hydroelectric capacity was enlarged by 60%, and we have since been adding to it at just about two and a half times the pre-war rate. Almost everywhere there are signs of a move to increase the capacities of power projects whose outputs have fallen behind the need.

As a basis of comparison—the world's largest power plant at Grand Coulee, Wash., has a capacity of some 2½ million hp. In Canada we have a known potential of about 66 million hp still waiting to be harnessed.

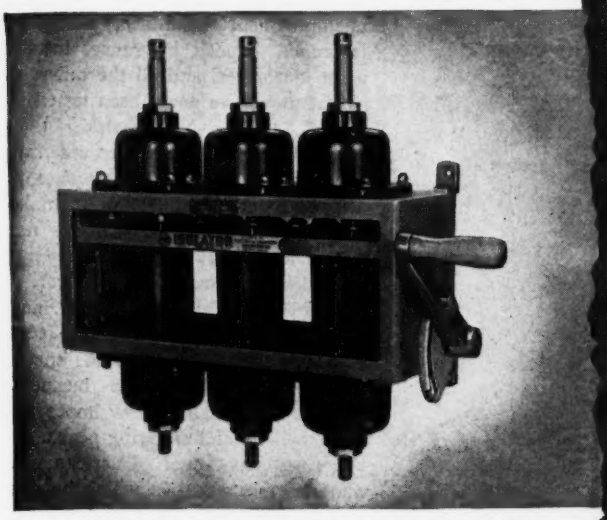
U. S. Prosperity Is Not a Phony One

JAMES H. JEWELL, vice-president in charge of sales, Westinghouse Electric Corp at 50th annual fall convention of the Rocky Mountain Electrical League, Colorado Springs, Colo

The subject of business depression is a big and complicated one, but I should like to make two points briefly concerning it.

It is important, first, to realize that our present prosperity is different from any in the past, and to understand what the differences are. Herbert Hoover ascribed chief responsibility for the 1929 collapse to the fact that the fruits of the tremendous increase in productivity of that decade went to too few people. That is not true today, for our income base has been broadened to lift millions of families above the poverty line.

Then there are the so-called "built-in" devices protecting us against a



Three pole single throw 400 ampere 5 kilovolt Air Interrupter ISOLATOR.

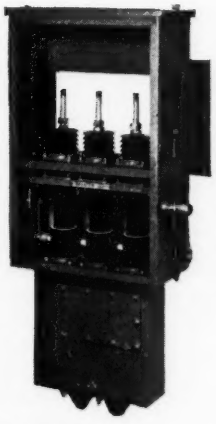
ISOLATORS need only 1/3 the usual space for transformer disconnects

The "Three E" Air Interrupter ISOLATOR is ideal for breaking magnetizing current of power transformers. Current is interrupted cleanly, and without external arcing or contact burning. Because of its unmatched design this device requires approximately one third the space needed for more conventional interrupting equipment.

Air Interrupter ISOLATORS are standard to 15 kilovolts and 600 amperes continuous rating.

SAVES POT HEAD INSTALLATION

If incoming power is supplied through a cable, the same economies can be effected. Pictured at right is an Air Interrupter Cable ISOLATOR with flanged throat for mounting on corresponding throat of transformer. Generally two separate pieces of equipment are required, a pothead for cable termination and an interrupter switch. The Air Interrupter Cable ISOLATOR provides both facilities making additional savings of space and materials possible.



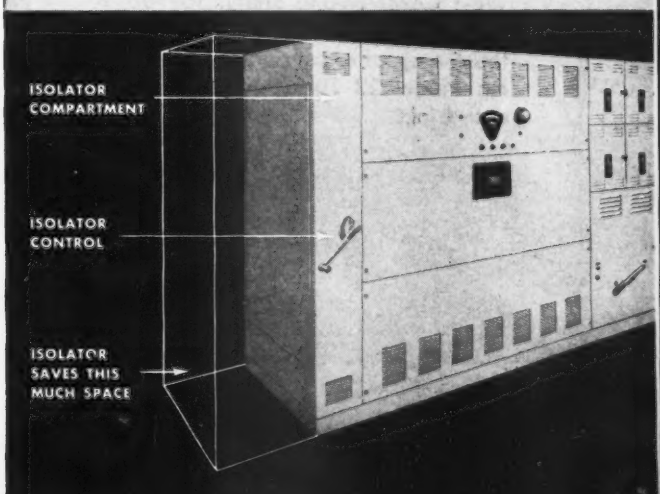
Three pole single throw 400 ampere 15 kilovolt Air Interrupter Cable ISOLATOR with transformer connection.

Send for our new bulletin 138.

SORGEL SAVES WITH ISOLATORS TO INTERRUPT MAGNETIZING CURRENTS

Below is shown one end of a 2000 K.V.A. Double End Unit Substation built by the Sorgel Electric Co., a prominent Transformer Manufacturer of Milwaukee, Wisconsin. Here they used Air Interrupter ISOLATORS to good advantage, for interrupting magnetizing current of each 1000 K.V.A. three phase, 13800 volt primary, air cooled transformer, and to isolate same from power source.

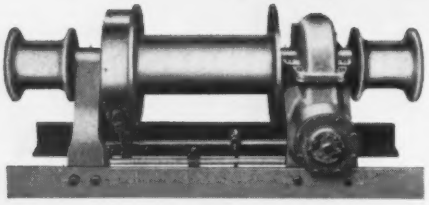
The ISOLATOR compartment was made considerably smaller than what would have been required if other types of interrupting equipment were used. Valuable space was saved, as well as steel required for building compartment.



ELECTRICAL ENGINEERS EQUIPMENT CO.

MELROSE PARK, ILLINOIS

TULSA* WINCHES



The Model 23 Tulsa Winch is installed on the truck below. There are 27 other models in capacities from 6,500 to 80,000 lbs. for all makes and models of trucks and crawler tractors.

FOR HAULING...

Loading and unloading 3-ton cable reels is a simple task for this California trucking contractor. Working for a West Coast public utility, the driver easily, quickly and safely handles these reels of expensive copper cable. His Model 23 Tulsa Winch does the entire job.

Tulsa* Winch
TULSA, OKLAHOMA
DIVISION OF VICKERS Inc

*Reg. U. S. Pat. Off.

serious economic downturn. One thing people forget about those devices—unemployment insurance, mortgage insurance, deposit insurance, installment mortgages, and all the others—is that they have never been tested in critical times. Nevertheless, they represent improvements that certainly contribute to a more stable economy.

The second point I want to make is that our present prosperity is **not** due to the cold war and it does **not** depend on continuance of that war.

Fact is that the time, money, and materials spent on defense are economically wasteful, and no one knows it better than American business. Every businessman I know hopes for an immediate and enduring peace. As much as any other American, he wants a sane world in which he can devote the creative facilities of his enterprise to truly useful peacetime production of goods in a better world.

Equivalent of Original Cost Is Best Valuation Base

ALBERT P. BRUCH, Wyoming, for the Valuation Committee of the National Association of Railroad and Utilities Commissioners at its convention in New York City.

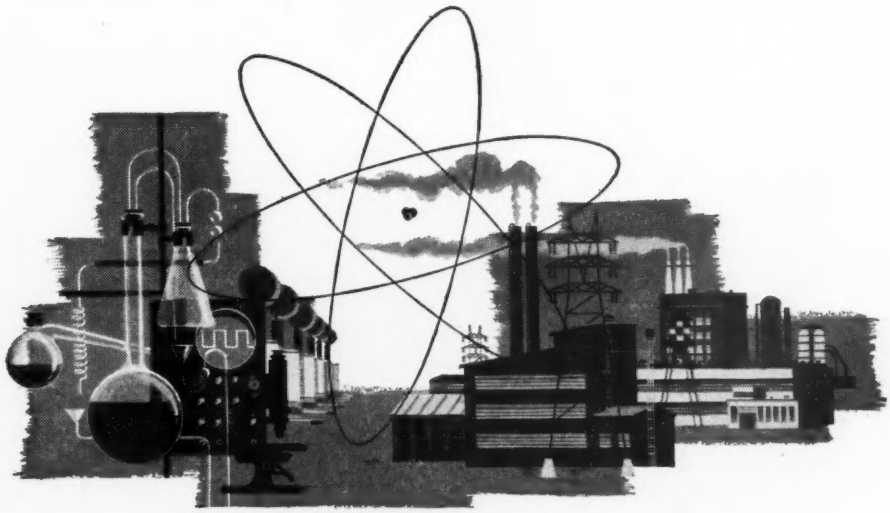
For a number of years the question whether depreciation cost for rate-making purposes should be based on the value of the property or on original cost has been a matter of controversy in proceedings before regulatory bodies and the courts. The evaluation methods proposed by the companies fall into two general classes:

1. Those which seek to base the current depreciation expense on the current dollar equivalent of original investment in depreciable assets.

2. Those which seek to provide full replacement cost of depreciable assets.

It is the committee's view that the former method offers the more practicable basis, since it is consistent in principle with conventional accounting treatment, differing from it only through recognition of the change in the value of the dollar between the date of original commitment in property and the accounting period in which recovery is to be made. This is a relatively simple process involving the trending of increments of investment in depreciable assets by the use of a general price index. Result, in effect, is a restatement of the original cost of such assets in terms of uniform dollars of current size.

NORTH AMERICAN AVIATION
is ready to build



NUCLEAR REACTORS FOR SCIENCE AND INDUSTRY

North American Aviation is ready now to design and build nuclear reactors to fit the research and power production needs of any qualified educational, medical or industrial group.

As in the case of proposals now in process, North American will provide all engineering services necessary for reactor development and operation, offering the widest possible range of reactor application. North American is also prepared to supply accessory equipment . . . as well as a variety of services essential to the success of various atomic projects.

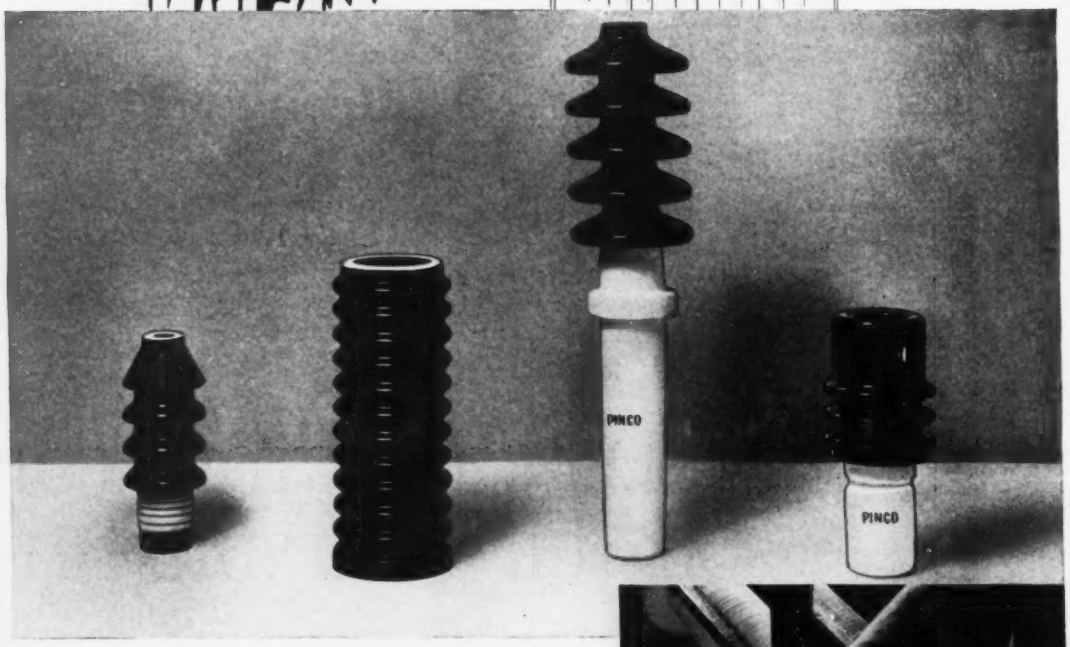
Through its work with the Atomic Energy Commission and other government agencies, North American has developed one of the most complete atomic research and production facilities to be found in private industry . . . staffed by one of the nation's largest groups of outstanding engineers and scientists.

North American invites your inquiry regarding reactor development or any other project in which atomic energy can be put to productive use. All reactor development is undertaken in accordance with the provisions of the Atomic Energy Act and subject to approval of the Atomic Energy Commission.

NORTH AMERICAN AVIATION, INC.

ATOMIC ENERGY RESEARCH DEPARTMENT • DOWNEY, CALIFORNIA

Custom-



The accompanying illustrations show but a few of the wide variety of bushings and special porcelain pieces which we have designed and/or produced. Research and experimentation are constantly increasing the adaptability of Pinco porcelain to larger and more intricate designs to meet new requirements of electrical and mechanical loading.

Dry profile turning gives dimensional fidelity to this special transformer bushing. The tool has a precision-ground carboloy cutting edge and follows a profiling pattern that guides it accurately.

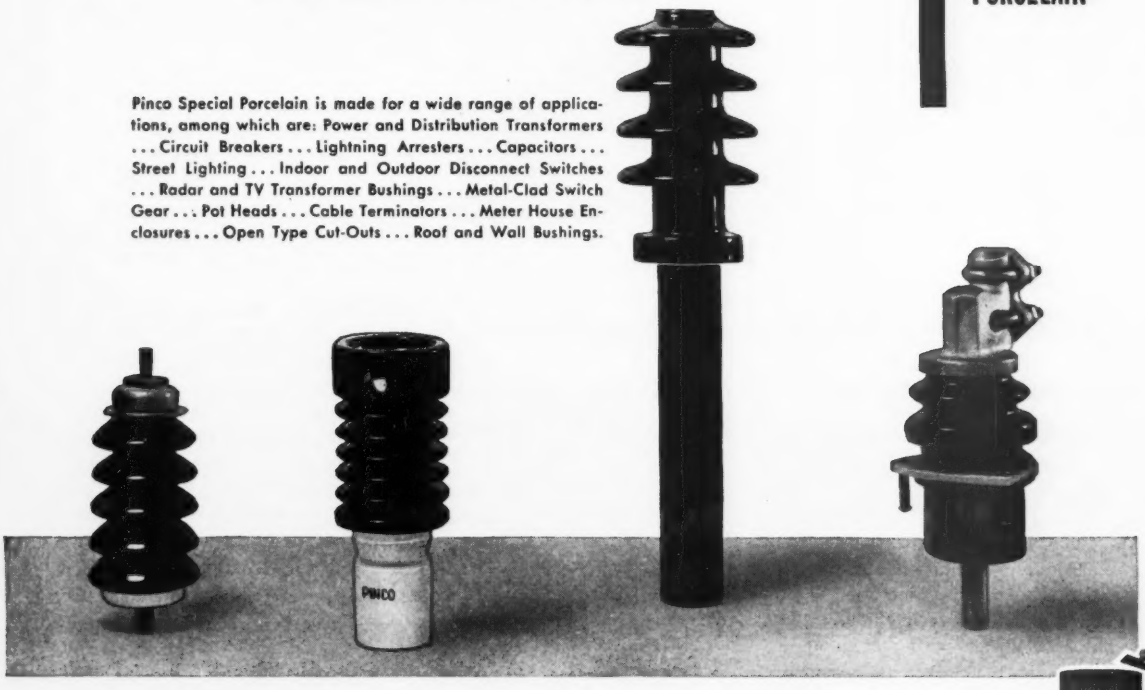
This section of the new "dry" finishing department shows several of the modern lathes which have been installed to take care of the increased demands for specially designed, turned bushings.

PINCO
2567
BUSHING

Made TO MEET SPECIFIC REQUIREMENTS

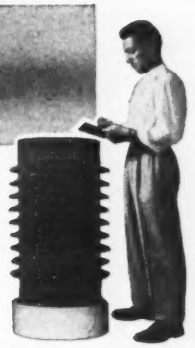
PINCO IS HEADQUARTERS FOR SPECIAL PORCELAIN

Pinco Special Porcelain is made for a wide range of applications, among which are: Power and Distribution Transformers ... Circuit Breakers ... Lightning Arresters ... Capacitors ... Street Lighting ... Indoor and Outdoor Disconnect Switches ... Radar and TV Transformer Bushings ... Metal-Clad Switch Gear ... Pot Heads ... Cable Terminators ... Meter House Enclosures ... Open Type Cut-Outs ... Roof and Wall Bushings.



In many applications of electrical porcelain, requirements are so specialized that standard designs are not usable or economically adaptable. The only satisfactory solution therefore is to create a new design to meet the particular need.

It is here where we can be of real service. The wide experience of Pinco Design Engineers in this field, plus Pinco's expanded and improved production facilities, are your guarantee of the highest quality custom-made porcelain at the lowest possible cost with delivery dates set up to coincide with your own production requirements. And don't forget ... Pinco *wet plastic porcelain* insures uniform density, strength and accuracy and unexcelled insulation—a fact well known in the utility field for over thirty years! *Like all Pinco products, every piece of special porcelain is electrically tested before being given the final okay.*



The same skill ... the same precise manufacturing standards and quality control enter into the making of every piece of Pinco special porcelain whether it be a small transformer bushing of this huge Current Transformer Bushing ready for firing.

If you manufacture equipment calling for porcelain of special design and fabrication, then we will welcome the opportunity to work with you in developing and/or producing such parts. Just send us blueprints or sketches and we will quote you promptly on your requirements. May we hear from you?
P.S. For specifications on *standard* Pinco Bushings, refer to Pinco Catalog No. 49, Pages 126-135 ... or write us for details.

The Porcelain Insulator Corporation
LIMA, NEW YORK

Suspension Insulators ... Clamps and Fittings ... Switch and Bus Insulators
Distribution and High Voltage Pin Types ... Guy and Tree Insulators ... Special Porcelain.

J. C. LINSENMEYER

JOHN W. BRENNAN

Linsenmeyer Made President

American Blower Corp elevates former vice president of manufacturing. Brennan named vice president of engineering

J. C. Linsenmeyer has been elected president of the American Blower Corp, a division of American Radiator & Standard Sanitary Corp. At the same time, it was announced that John W. Brennan, formerly chief engineer, has been elected vice president of engineering.

Linsenmeyer, who prior to his elevation was vice president of manufacturing, succeeds the late Clark T. Morse. He became associated with American Blower as an air conditioning engineer in 1931. He was appointed manager of the company's Columbus, Ohio, plant in 1940, works manager in 1946 and vice president of manufacturing in 1951.

The new president was graduated from the University of Detroit and is a member of the National Society of Professional Engineers.

Long-Time Association . . . Brennan began his career with American Blower in 1927, following his graduation from the University of Notre Dame. After serving as a sale engineer in the Buffalo branch, he was named manager of the San Antonio branch in 1930, and two years later manager of the St. Louis branch.

In 1934 he became manager of the Industrial Department of the Detroit sales office. In 1945 he was named manager of the company's Hydraulic Coupling Division, and served in that capacity until named chief engineer in 1951.

J. Calvin Hill, manager of the Fort Wayne Division of Indiana & Michigan Electric Co since 1948, has been appointed to the utility's board of directors to fill the vacancy created when Audrey N. Prentice resigned as assistant general manager of I&M to accept a similar post with Ohio Power Co (EW, Aug. 17, p 33). Both companies are subsidiaries of American Gas & Electric Co.

Arthur E. Rowe has been named manager of sales for General Electric Co's newly formed Ballast Department. A graduate of Indiana University and the Graduate School of Business at Harvard University, he joined GE in Fort Wayne, Ind., in 1946.

W. D. Sullivan, assistant works manager of the Tubular Products Division of Babcock & Wilcox Co at Beaver Falls, Pa., has been transferred to the company's Boiler Division to become regional manager of the manufacturing department. Sullivan, who joined B&W at its Barberton (Ohio) plant in 1916, will now assist in the co-ordination in the manufacturing activities in the Boiler Division.

J. H. MEAD

E. R. PETERSON

R. P. O'BRIEN

Southern California Names Three VPs

Southern California Edison Co has elected three new vice presidents from within the corporation. They are: J. H. Mead, formerly vice president, commercial department; E. R. Peterson, formerly assistant comptroller; and Robert P. O'Brien, formerly assistant vice president, rate and valuation department.

Mead joined the company in 1922 and prior to his appointment as assistant vice president in 1950, he was district manager in Pomona and in Long Beach. Peterson came to the organization as a trainee from the California Institute of Technology in 1926. He was elected assistant comptroller in 1948 following several years as head of the company's tax department. O'Brien formerly was with the California Public Utilities Commission and joined the company in 1952. He was emergency power director and head of the power division of the commission in 1948.

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Certified Quality—Carbon, Alloy, Stainless

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Fifteen Plants from Coast to Coast

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Metallurgists and Veteran Steel Men

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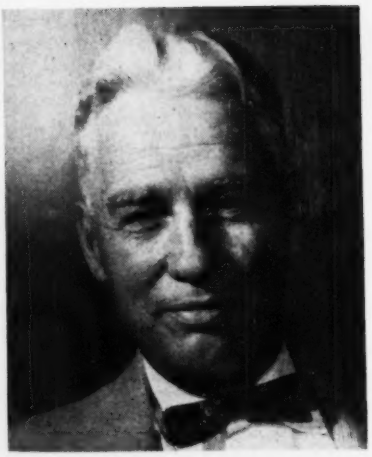
There's no surer way to get economical and effective preservation of galvanized structures than by coating them with Subox or Subalox. In most instances, a single coat is sufficient and Subox or Subalox—will not chip, crack or blister during years of exposure to the elements.

What's more, repainting is simpler and more economical when these paints are used. They cost no more than any good paints, and can be relied on to save you money for years.

Write for a free copy of "Paint Galvanized Transmission Towers for Long Life".

Subox Inc.

3 FAIRMOUNT PLANT
HACKENSACK, N. J.



T. CORTLANDT WILLIAMS

Williams Named . . .

. . . executive vice president of Stone & Webster; will hold former duties

T. Cortlandt Williams has been elected executive vice president of Stone & Webster Engineering Co, with joint headquarters in New York and Boston.

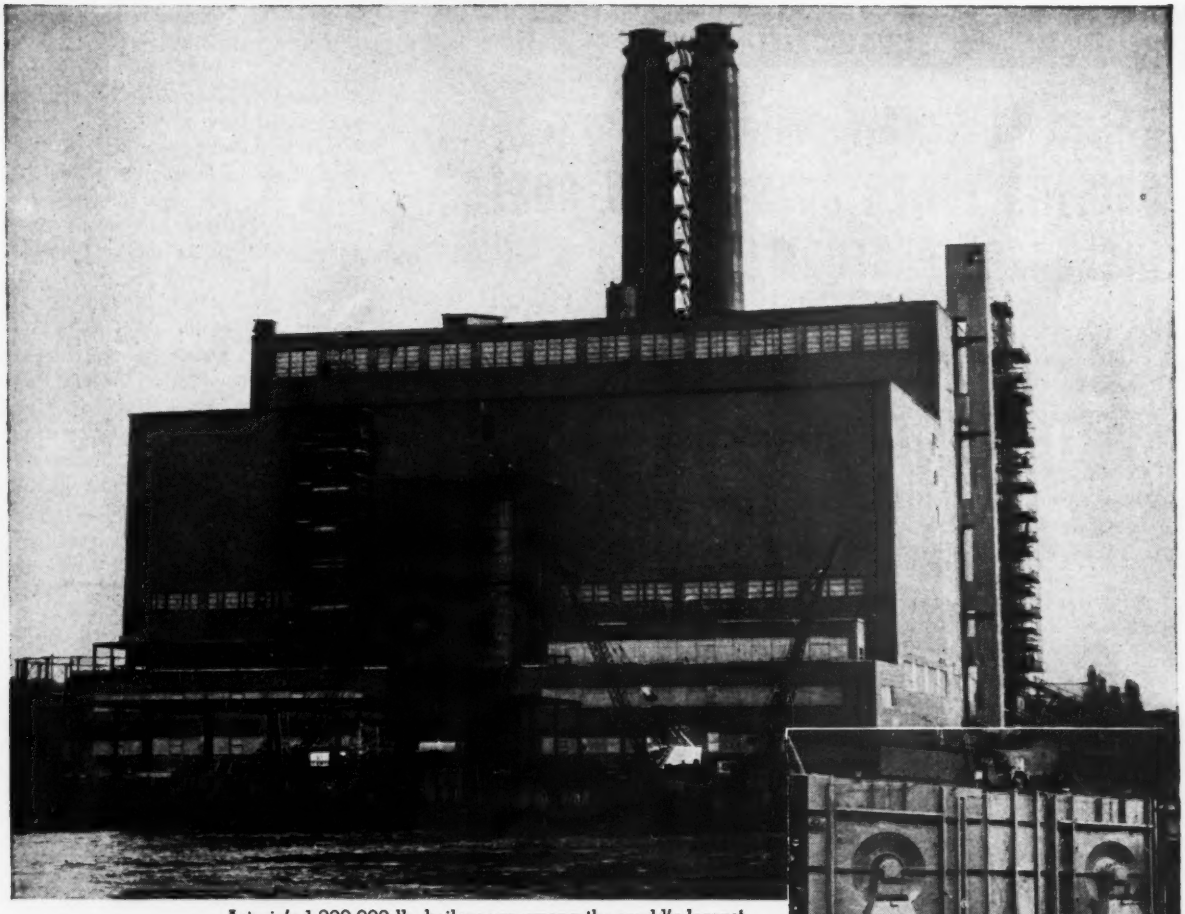
Williams, who lives in Wellesley Hills, Mass., will continue his present responsibilities as senior construction manager, and will be responsible also for executive direction and coordination of the activities of the organization at Boston.

Williams, who joined Stone & Webster in 1923 working in field construction, holds engineering degrees from Bucknell University, Lewisburg, Pa. He was elected vice president and senior construction manager in 1947 and a director in 1950.

•

Kenneth W. Van Gundy, commercial manager of Pacific Gas & Electric Co's Shasta Division in northern California, has been promoted to manager of the newly-created San Mateo district. **Loren A. Woolf,** Sacramento division sales supervisor, has been appointed as his successor.

David W. R. Morgan, vice president of Westinghouse Electric Corp and general manager of the firm's South Philadelphia plant since 1946, has been named to the headquarters staff of **John K. Hodnette,** vice president in charge of all the company's Industrial Products Division. Morgan, a



Astoria's 1,200,000 lb. boilers are among the world's largest. Sturtevant fans furnish 600,000 CFM forced draft on each.

NEW AIRFOIL FANS

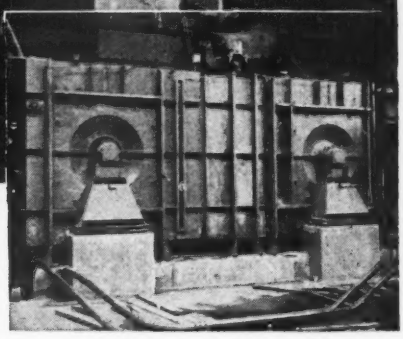
GIVE GREATEST ECONOMY AT ASTORIA

Pressurized boilers at Consolidated Edison's Astoria Station are designed to operate without induced draft. In a fan arrangement never before used by a public utility, eight new Sturtevant Airfoil-Bladed Fans are connected in series of two for forced draft.

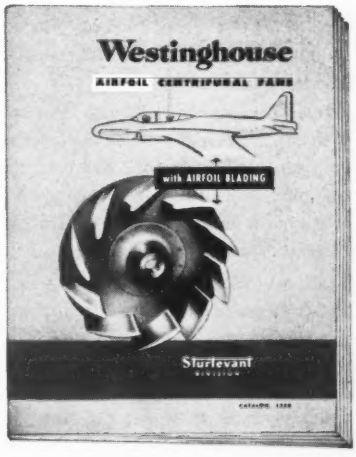
Each tandem is rated for 300,000 CFM at 38" pressure. At part loads, only one fan of each pair is used. Thus the fans operate at or near peak efficiency at all times.

Airfoil-Bladed Fans retain the self-limiting horsepower characteristics and reach peak efficiencies of *over 90%.* They are designed primarily for application where low operating cost and quiet operation mean more than first cost.

For full information on the Airfoil-Bladed Centrifugal Fan, ask for new Catalog 1320. Call your Westinghouse-Sturtevant office. Westinghouse Electric Corp., Sturtevant Division, Hyde Park 36, Mass.



The "boxcar" being installed above houses two Airfoil Fans in tandem. Two units totaling four fans serve each boiler. A unique by-pass system permits operation of any two fans in each four-fan unit. All fans are equipped with power-saving Vane Control® to permit instantaneous control of output.



WESTINGHOUSE AIR HANDLING

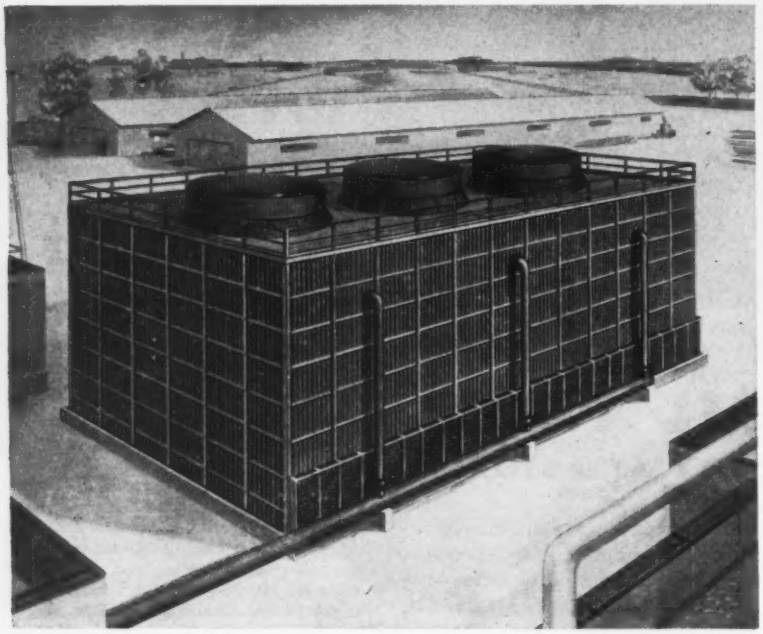
YOU CAN BE SURE...IF IT'S Westinghouse

(Advertisement)

INDUSTRY NEWS IN BRIEF

SANTA FE'S NEW "MD-54" COOLING TOWER CUTS INITIAL COSTS, INCREASES PERFORMANCE

Los Angeles . . . Cooling tower *design* has undergone a number of significant improvements. After holding faithfully to the basic pattern, the Santa Fe Tank & Tower Company, Los Angeles, has taken an aggressive step toward developing a cooling tower with a substantially improved construction design. The newly designed tower is said to require fewer parts for construction, which in turn, allows for faster erection and less maintenance.



Santa Fe engineers branded their new tower the "MD-54" which is the result of a series of laboratory and field tests that measured all *performance* factors in relation to its new structural features. *Simplified* construction and better utilization of materials in the "MD-54" is the *key* to the new design and improved performance.

Santa Fe engineers have designed for the "MD-54" two separate and distinct standard types of wetted surfaces. After a series of extensive tests, it was found that one surface is best suited to lowest first cost, and the other surface to the lowest evaluated cost on an amortized basis. This makes the "MD-54" the most adaptable to meet the requirements of each individual plant.

According to Santa Fe, the basic design of the "MD-54" cooling tower allows for the largest possible range of size variations.

A new bracing system designed for minimum obstruction to the free flow of air results in better cooling performance. This new bracing requires only two specially designed joint connectors in conjunction with 3 standard braces to build any size or combination of sizes, shapes of the "MD-54" cooling tower.

Santa Fe Tank & Tower Co., 5401 So. Boyle Ave., Los Angeles 58, California

veteran of 40 years' service with Westinghouse, will make his headquarters in Pittsburgh.

Maynard W. Johnson has been named manager of General Electric Co's distribution transformer plant in Oakland, Calif. He succeeds **Paul R. Hartig,** who has been named manager of employee and plant community relations for GE at Pittsfield, Mass.

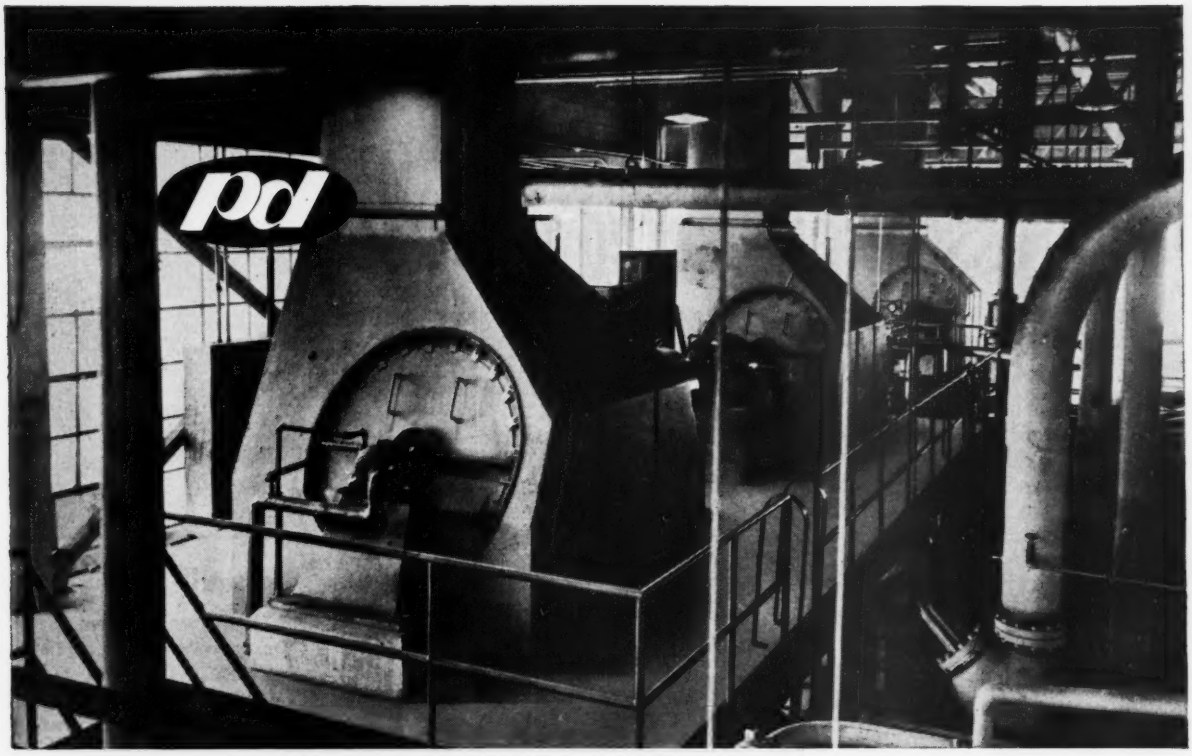
Prof Arnold Tustin, head of the department of electrical engineering at the University of Birmingham, England, has been appointed to the Webster Chair of Electrical Engineering as a visiting professor at the Massachusetts Institute of Technology for the academic year 1953-54.

P. R. KNAPP

Toledo Edison Names Knapp Vice President

P. R. Knapp, a Toledo Edison Co engineer for 36 years, has been named a vice president of the company. He will be head of the company's operations and engineering. At the same time, H. H. Kerr, former vice president in charge of operations, was promoted to vice president and executive engineer.

Knapp came to Toledo Edison in 1917 after receiving an electrical engineering degree at Worcester Polytechnic Institute. He became head of the company's production engineering department in 1922, assistant superintendent of electric distribution in 1924, and superintendent in 1933. He was the utility's general superintendent from 1945 until assuming his present post.



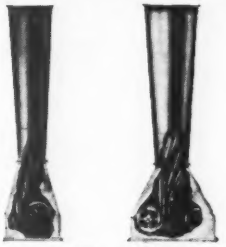
P-D Dust Collectors and Fan Stacks Provide Maximum Flexibility and Unit Efficiency at Western Electric

sturdy, self-supported units... clean cut layout arrangements

It takes steam—lots of steam—to keep Western Electric's big Indianapolis plant turning out millions of telephones each year. During processing, sizable quantities of steam are needed and in addition over a million square feet of factory and office space must be heated.

The system that solves this problem is designed to deliver 187,000 lbs. per hour of steam, from three 60,000 lb. per hour steam generators and a 7,000 lb. per hour, incinerator boiler. The four units are equipped with an integrated arrangement of Prat-Daniel Dust Collectors, Induce Draft Fans, Breechings and Stacks. Small diameter tubes in the P-D Collector develop a high centrifugal force, providing maximum operating efficiency even at widely varying loads. The straight P-D Fan Stacks are of sturdy self-supporting construction. Flow through arrangement reduces resistance, providing more efficient draft production.

Engineered by Allen and Kelly of Indianapolis in collaboration with Western Electric's engineers,



SINGLE FAN TYPE TWIN FAN TYPE

Stacks and Dust Collectors were project engineered by The Thermix Corporation.

You too can have specialized help in solving your dust and draft problems. Call or write Thermix today.

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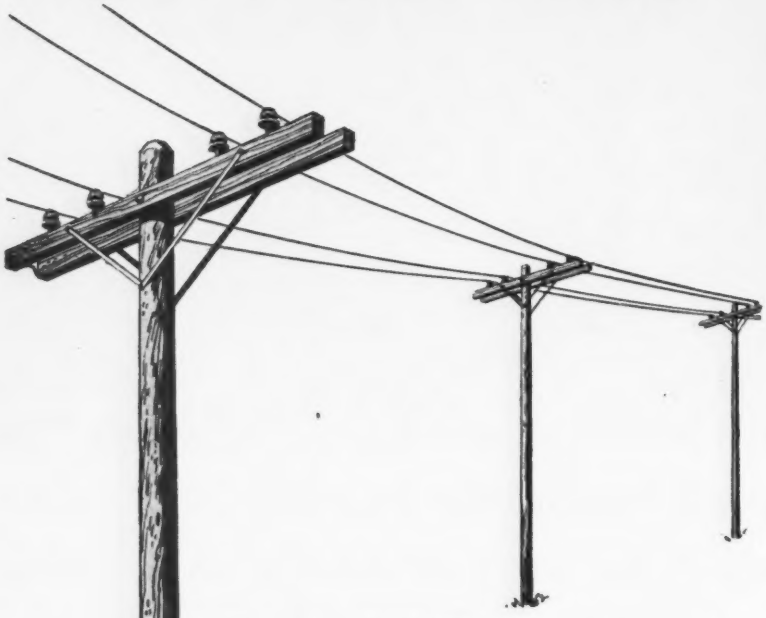
POWER DIVISION: Tubular Dust Collectors, Forced Draft Fans, Air Preheaters, Induced Draft Fans, Fan Stacks

What KOPPERS means on pressure-creosoted poles



Dependability from an organization that stands behind its products.

Quality long-lasting poles, pressure-creosoted in strict adherence to specifications, are assured by laboratory control over plant production from a technical department that is the best in the industry.

Service from highly trained and experienced personnel in our many strategically-located plants.

You can count on *Koppers*—the best-known name in pressure-treated wood.

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KOPPERS **PRESSURE-TREATED WOOD**

OBITUARY

E. C. Marshall

Edward Carrington Marshall, president of Duke Power Co since 1949, died last month in Charlotte, N. C. The 76-year-old Virginia-born executive had been associated with the Duke interests since 1907.

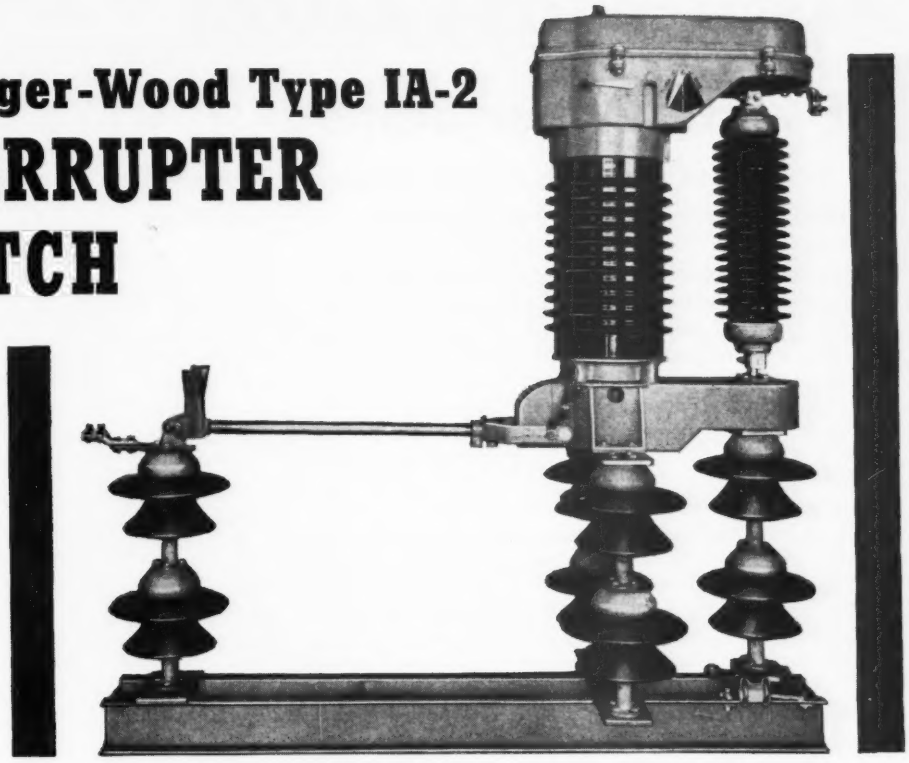
A great-grandson of Chief Justice John Marshall, he went to Charlotte as auditor for the Southern Power Co and had an active part in the acquisition and management of the utility systems of many cities in the Carolinas as the company expanded.

He was named treasurer of Southern Public Utilities Co in 1913 and president in 1921. He held the latter office until the company was consolidated with Duke Power in 1935. He was named a Duke Power director in 1925, vice president in 1934, and president in 1949.

Will H. Fischer, 78, retired vice president of the Southern California Edison Co, died Oct. 4 at Los Angeles. He was a member of the Edison organization for 25 years until his retirement at the end of 1947. He represented the company in legislative matters and in 1931 was elected a vice president.

Warren W. Bell, 60, vice president of Carolina Power & Light Co and president of the former Tide Water Power Co, died this month after a short illness. Before becoming associated with Tide Water in 1943, he served as vice president, treasurer, and director of Northeastern Electric & Water Co of New York City. He had operated utility properties more than 30 years.

Schwager-Wood Type IA-2 INTERRUPTER SWITCH



Single Pole 69 KV-250 MVA shown above. The switch is available in ratings from 34.5 KV to 115 KV. The 115 KV Interrupter Switch is also available in an interrupting rating of 500 MVA.

The Schwager-Wood Interrupter Switch offers real economies in switching and protection of transformer banks, and in the dropping of long line charging currents. This switch also gives protection against faults within the range of its interrupting rating.

Low original cost, minimum installation and maintenance expense have proved this Interrupter Switch to be a money-saving investment.

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GE Cartel Action Settled

International agreements on electrical equipment dissolved. Consent decree may set antitrust precedent

General Electric Co and the government have signed a consent judgment ending GE's international cartel covering electrical equipment. This action came only a few days after the antitrust judgment against GE for monopolizing the domestic electric lamp industry.

The cartel charges—really a part of the package antitrust fight launched by the Justice Department years ago—were filed in 1945 in the same Federal court in New Jersey, where several years earlier the lamp monopoly case got under way.

The Justice Department charged GE and its international company signed illegal cartel agreements between 1892 and 1939 with foreign companies in Great Britain, France, Belgium, Germany, Italy and Japan.

The agreements allocated territories and pooled patents and know-how on the manufacture, sale, and distribution of all types of electric equipment, except electric lamps and radio equipment. GE's international electric lamp agreements were cancelled in the antitrust action (EW, Oct. 12, p 43).

Agreements Cancelled . . . Under the terms of the cartel consent judgment, all restrictive agreements are eliminated and formulation of similar contracts in the future are prohibited.

GE must license at a reasonable royalty about 600 patents it tied up through the cartel, as well as all others it has now or gets in the future which are necessary to make use of them.

The consent decree in the cartel case is consistent with the judgment in the electric lamp case—which already is being regarded in government antitrust circles as a new antitrust landmark.

Reason: antitrust lawyers say monopolies today and in the future are more likely to be built up by control of the technology—the know-how—of an industry than by cornering the market for a single product. The GE lamp judgment is the first based clearly and solely on a monopoly of research and technology. And it marks the first time in antitrust litigation history that a court ordered dedication of patents used to build a monopoly.

The key part of that judgment—written by Judge Phillip Forman—orders GE to dedicate to the public all existing GE patents on the manufacture of lamp bulbs and parts. This amounts to making a gift of the exclusive rights granted originally by patents; this was the major demand pressed by government lawyers.

General Electric opposed inclusion of the patent part of the judgment and may appeal it to the Supreme Court. But government lawyers are ready to battle on this.

Still Undecided . . . The U. S. Supreme Court has touched before on the authority of lower courts to order royalty-free compulsory licensing—which is about the same thing as dedication but for minor legal differences.

It is still an undecided issue, however.

Government antitrust lawyers think they can support Judge Forman's order as a "logical development from the Hartford-Empire case through National Lead and Alcoa."

This argument refers to prior court decisions recognizing results similar to dedication in comparable circumstances.

In the Hartford-Empire case (1945), the Supreme Court approved for the first time compulsory licensing on a reasonable royalty basis, in a glass-making machinery case. This decision showed that the courts will break up a patent or group of patents if it is proved that they were the key to a violation of the antitrust laws.

Then in 1947, the Supreme Court approved some royalty-free licensing in the National Lead case—without saying it could be used in other cases.

And in 1950, the antitrusters moved another step along the way in the Aluminum Co of America case. Alcoa had arranged to give royalty-free license to the Reynolds and Kaiser aluminum companies. Kaiser and Reynolds were to reciprocate by "granting back" to Alcoa their own patents.

The government got Federal Judge Knox to strike out the grant-back provisions in the Alcoa monopoly decision.

This left Alcoa a royalty-free licensor by court action.

The GE dedication, so the argument goes, is a reasonable follow-up in this line of cases.

Foreign Bids Asked on Generators for Japan

The Electric Power Resources Development Corp of Japan has invited four foreign and three Japanese major electric equipment manufacturers to submit bids for four 93,000-kw generators to be installed at the Sakuma power station now under construction in upper Tenryu River. Bidding will close at the end of November. American firms invited are Westinghouse Electric Corp and General Electric Co.

Total cost for the project will be $100 million, of which $11,111,000 will be for the generators. Construction of a dam was started early in the summer by Guy Atkinson Co of California, which has brought in $4,500,000 worth of various construc-

MANUFACTURERS EARNINGS

Company	Period Months Ended		Net Income 1953	Net Income 1952	Earnings Per Common Share 1953	Earnings Per Common Share 1952
Midwest Piping	6	Aug.	$1,163,590	$1,005,248	$1.51	$1.30(a)
Monsanto Chemical	3	Sept.	6,183,986	4,979,508	1.14	.92
Monsanto Chemical	9	Sept.	19,687,960	16,080,360	3.65	2.97
York-Hoover	12	June	208,114	272,460	1.51	1.97

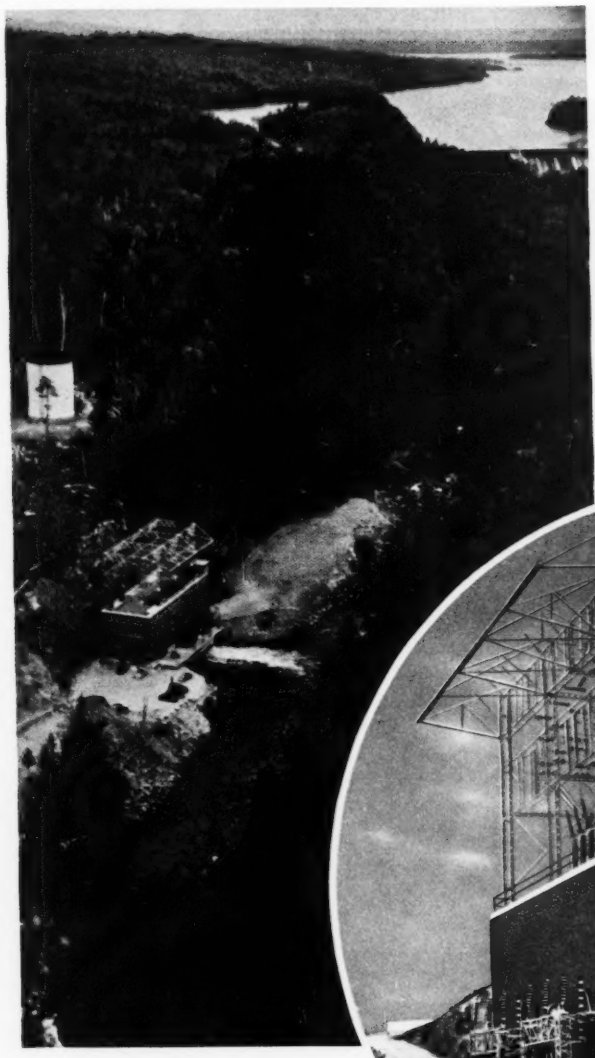
Notes—(a) Based on shares now outstanding.

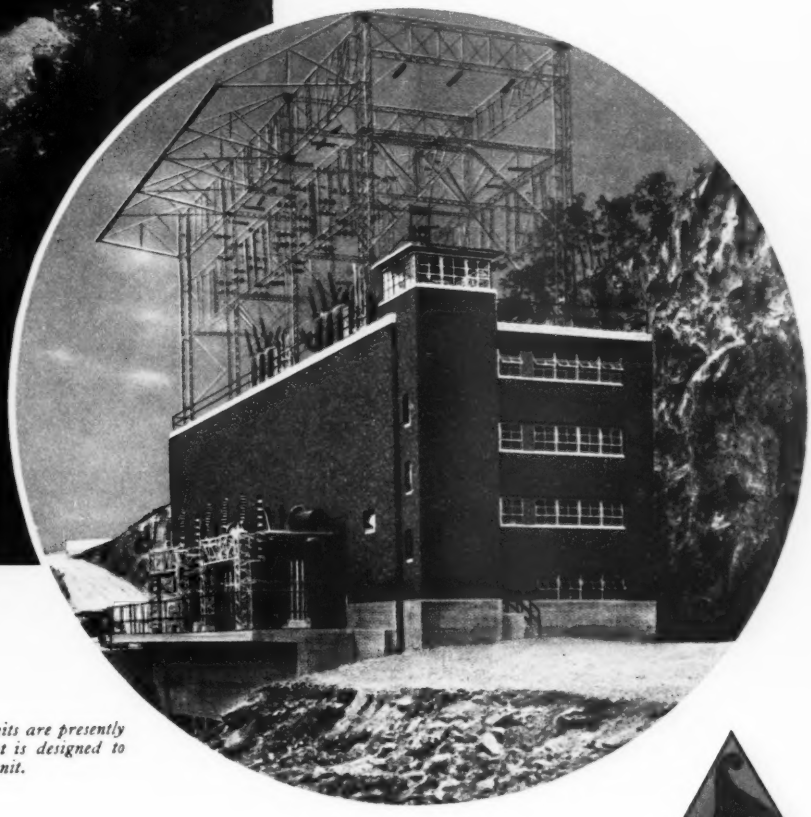
POWER FOR PAPER PRODUCTION

When Great Northern Paper Company needed more power for its operations in northern Maine, Stone & Webster Engineering Corporation was called on for consultation and recommendations.

The Corporation prepared a report, and subsequently designed and built the Ripogenus hydroelectric project on the upper Penobscot River. Water from a storage dam is brought downstream through a solid rock tunnel for 4000 feet to McKay Station.

The transmission line connection to the Millinocket plant and the required road work and bridges were engineered and constructed by Great Northern's own forces.

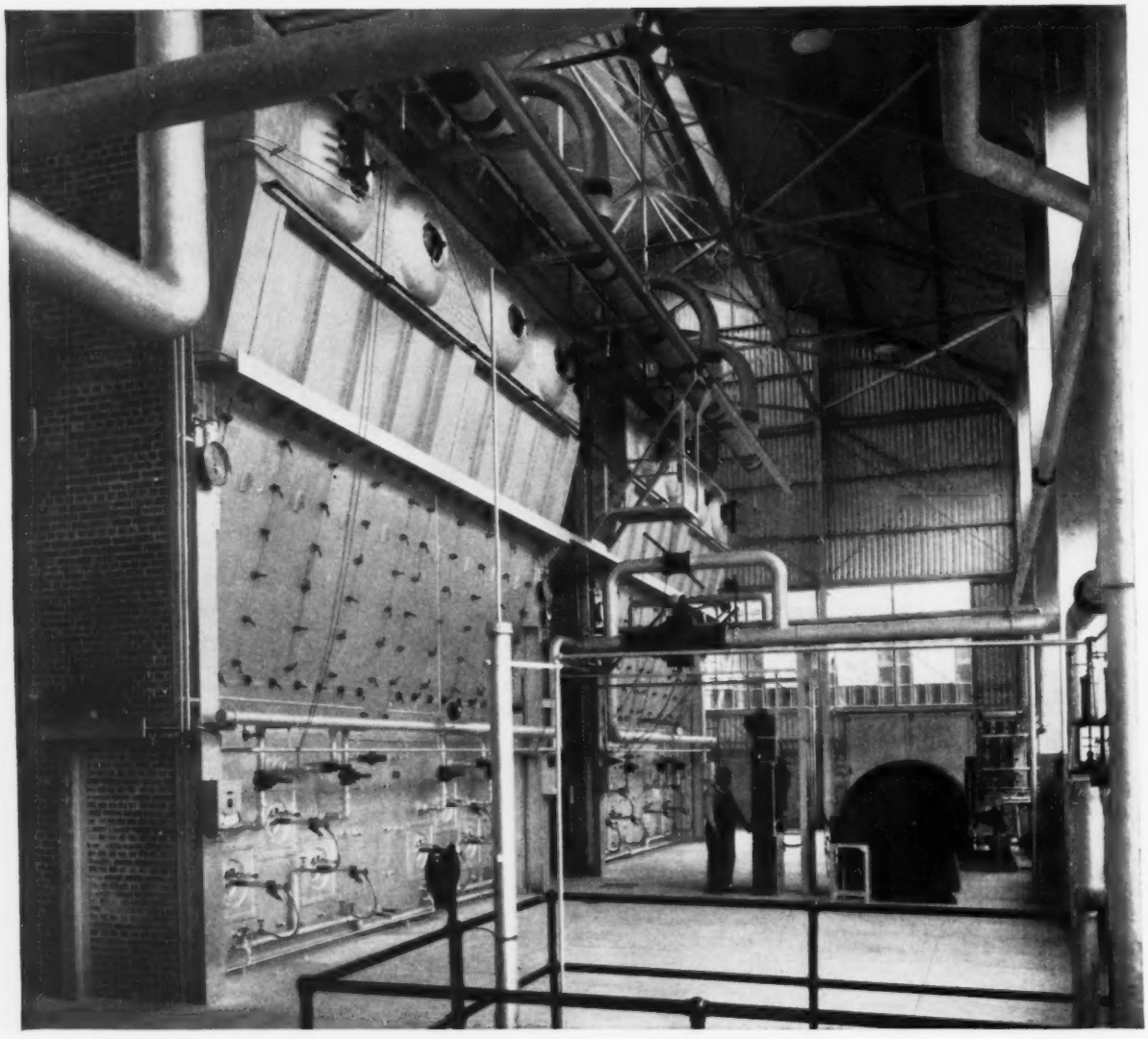




Two 13,500 kw units are presently installed. The plant is designed to house a third such unit.

STONE & WEBSTER ENGINEERING CORPORATION

A SUBSIDIARY *of* STONE & WEBSTER, INC.



How to brighten dark rooms with just one coat of paint

When you consider labor costs on a job like this, you soon realize that it's only good business to use the best quality paint. Particularly when an aluminum paint formulated to your specific needs may well save you the cost of a second coat.

While Alcoa does not make paint, it's our business to know all about the aluminum pigments that go into the best brands. We supply most of them. Working together, Alcoa technicians and leading paint manufacturers have found ways to combine pigments and vehicles for the utmost protection against the most common industrial paint problems—heat, cold, dirt, moisture, smoke, fumes and corrosive action.

If there's a spot that needs brightening in your plant—or a smokestack, tank, boiler or other equipment that deserves preserving—find out how far a brushful of the *right* aluminum paint will go, *how long it will last.*

Ask your paint supplier about specially formulated aluminum paints made with Alcoa® Albron Pigments. Or tell us your problems. We'll gladly recommend the correct type of aluminum paint for your job.

For a free copy of our 32-page booklet, *Painting with Aluminum*, just call your local Alcoa sales office or write: Paint Service Bureau, Aluminum Company of America, 1787-K Alcoa Building, Pittsburgh 19, Pennsylvania.

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ALUMINUM COMPANY OF AMERICA

tion equipment already. All other equipment, materials, and labor are supplied domestically.

MEETINGS CALENDAR

American Standards Association
4th National Standardization Conference and 35th annual meeting, Waldorf-Astoria, New York, Oct. 19-21.

***Edison Electric Institute**
Meter and Service Committee, William Penn Hotel, Pittsburgh, Nov. 19-21; Electrical Equipment Committee, Jung Hotel, New Orleans, Nov. 2-3; Market Development and Electrical Applications Committee, Washington, Nov. 3-4; Accounting Executive Committee, Edgewater Beach Hotel, Chicago, Nov. 12-13; EEI-AGA General Accounting Committees, Jung Hotel, New Orleans, Nov. 30-Dec. 1.

American Standards Association
4th National Standardization Conference and 35th Annual Meeting, Waldorf-Astoria, New York, Oct. 19-21.

University of Texas
Power Distribution Conference, Department of Electrical Engineering, Lower Colorado River Authority Auditorium, Austin, Oct. 19-21.

Public Information Program
Steering Committee, Edgewater Beach Hotel, Chicago, Oct. 21; Workshop Conference, Edgewater Beach Hotel, Chicago, Oct. 22-23.

Oklahoma Utilities Association
Electric Light and Power Division, Eastern District, Vinita, Okla., Oct. 22; Western District, Norman, Okla., Oct. 23.

Pennsylvania Electric Association
Fall Meeting, Meter Committee, Brunswick Hotel, Lancaster, Pa., Oct. 22-23; Fall Meeting, Communications Committee, Hotel Brunswick, Lancaster, Pa., Oct. 29-30; Fall Meeting, Systems Operation Committee, Castleton Hotel, New Castle, Pa., Nov. 5-6.

National Association of Suggestions Systems
11th Annual Convention, Hotel William Penn, Pittsburgh, Oct. 26-27.

American Institute of Electrical Engineers
Fall General Meeting, Muehlebach Hotel, Kansas City, Mo., Nov. 2-6.

National Electrical Manufacturers Association
Annual Meeting, Haddon Hall, Atlantic City, N. J., Nov. 9-12.

Wisconsin Utilities Association
Electric and Gas Section Convention, Schroeder Hotel, Milwaukee, Nov. 11-13.

Pacific Coast Electrical Association
Annual Hawaiian Conference, Honolulu, T. H., Nov. 19-20.

New Jersey Utilities Association
Annual meeting, Seaview Country Club, Absecon, N. J., Nov. 19-20.

Southeastern Electric Exchange
General Sales Conference, Atlanta Biltmore Hotel, Atlanta, Ga., Nov. 19-21.

American Society of Mechanical Engineers
Annual Meeting, Statler Hotel, New York, Nov. 29-Dec. 4.

Interstate Power Club
Hotel Martinique, New York, Dec. 7.

Eastern Joint Computer Conference-Exhibition
Sponsored by Institute of Radio Engineers, Association for Computing Machinery, and American Institute of Electrical Engineers, Statler Hotel, Washington, D. C., Dec. 8-10.

Public Utilities Advertising Association
Region Two, Annual Meeting, Skytop, Pa., Dec. 10-11.

*Addition this week.

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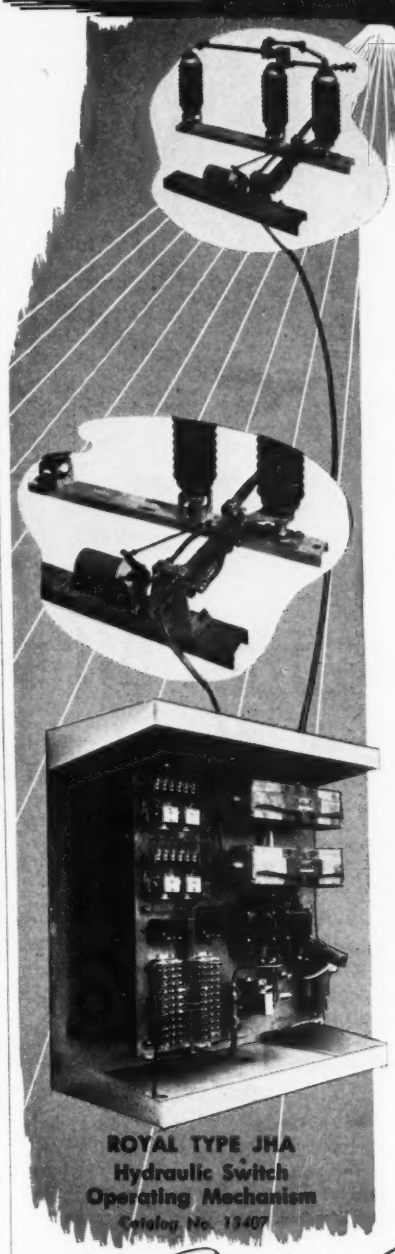

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- High-speed operation. Adjustable time cycle.
- Repeated, remote line sectionalizing or tandem switching operations.
- Control and pump motor circuits independently wired, can be fed from the some or different sources.
- Unit will operate two or more switches, with separate relaying for each.
- Pump automatically maintains accumulator pressure.
- For all control voltages. Adaptable to any group operated switch.

ROYAL hydraulic switch operating mechanisms have been supplied for several years in hand and motor-operated types. They are easy to install, without elaborate layout drawings. No mechanical linkages are required; slave cylinder is connected directly to switch. Connecting tubing is readily formed for attachment to existing or new substation structures, and can be run underground or overhead to a central control point.

• Catalog No. 12 listing ROYAL connectors, switches and substation fittings has just been published. Write for your copy.

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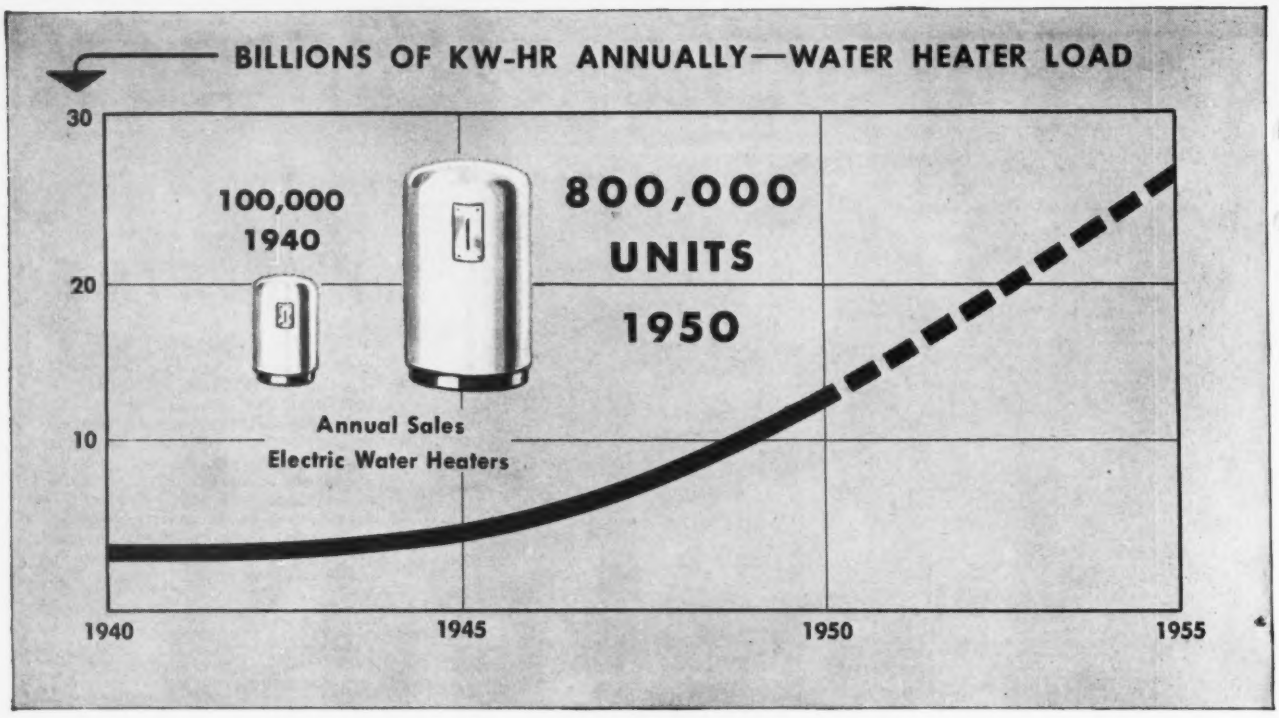


Three Benefits from Off-peak Control of Electric Water Heaters

By 1960 the electric water heater load will double, annual sales of electric water heaters will be an estimated 1,800,000, and the total annual water heater load will be nearly 35 billion KW hours.

OPPORTUNITIES IN OFF-PEAK CONTROL

The question: *how can expanding water-heating loads be added most economically to existing systems?*

The answer: off-peak control of electric water heaters by time switch or 720-cycle.

RELEASED SYSTEM CAPACITY

Let's assume that there are 20,000 electric water heaters on a system. Multiply this number by 0.6 (the average KW demand per heater) and get the number of KW's released in the distribution system: approximately 12,000 KW's. Now apply the formula to *your* system and see how much capacity off-peak control can release for you.

LOWER INVESTMENT COSTS

Installed new capacity costs, per 0.6 KW, approximately $300. But off-peak control eliminates the need for new capacity to handle the growing water heater load. It costs $25 to $50 per heater or 0.6 KW.

INCREASE SYSTEM LOAD FACTOR

For example: a substation serves 100,000 customers. 10,000 have water heaters and 30,000 have electric ranges. Assuming an average load of 50,000 KW and a peak load of 90,000 KW (without control), load factor (the ratio of average load to peak load) is 56%.

But if the 10,000 water heaters are controlled from 5-10 P.M. (see chart, lower right) the peak load is reduced by 10,000×0.6 per heater, or 6000 KW. Peak demand is lowered to 84,000 KW. Load factor is 60%—a 7.1% improvement in system efficiency.

TWO TYPES OF CONTROL

The two most popular methods of control are time switch and 720-cycle. A system study is necessary to determine which type of control is most applicable.

FOR MORE INFORMATION

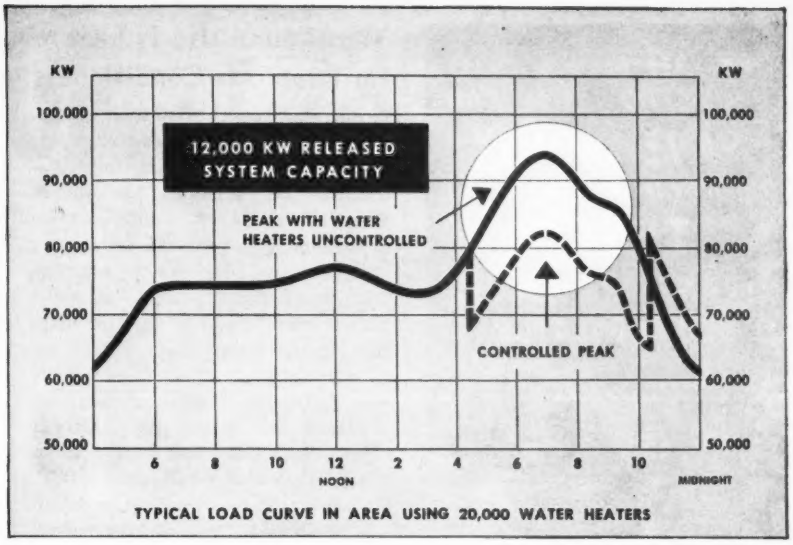
Call your General Electric Apparatus Sales Office, where a G-E representative will be glad to discuss off-peak control in terms of *your* system. Ask about the G-E color slidefilm on off-peak control. Or write for Bulletin GEA-5819 to Section 603-156, General Electric Co., Schenectady 5, New York.

You can put your confidence in—

GENERAL ELECTRIC

1.

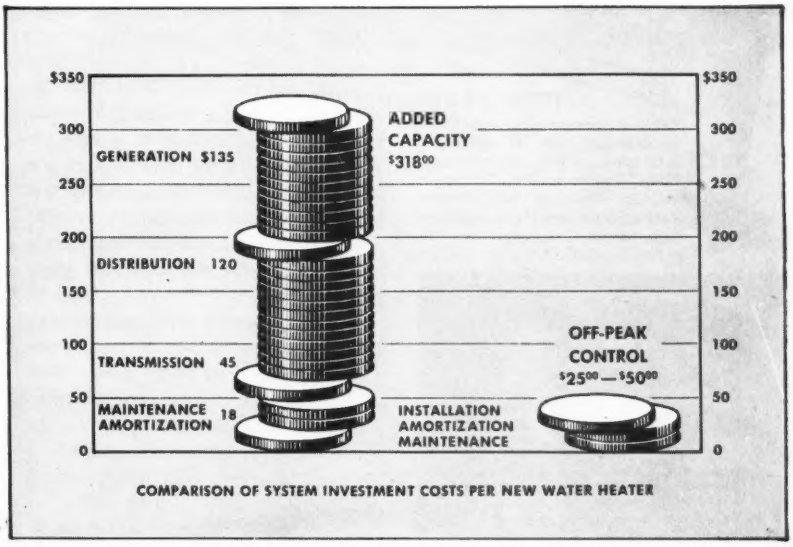
RELEASE SYSTEM CAPACITY. Multiply the number of water heaters on your system by 0.6 (average KW demand per heater) and find out how many KW's could be released in *your* system.



TYPICAL LOAD CURVE IN AREA USING 20,000 WATER HEATERS

2.

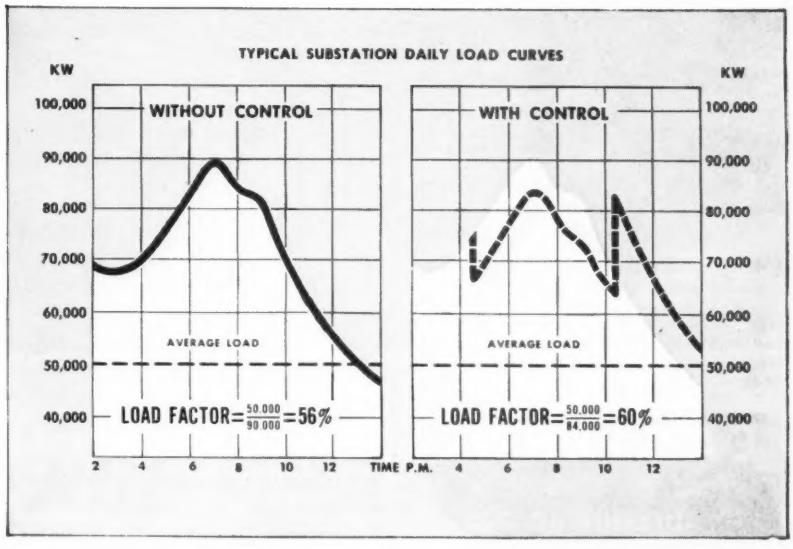
LOWER INVESTMENT COSTS. Where pronounced peak loads occur it is not necessary to install new capacity—off-peak control costs only $25–$50 per heater.



COMPARISON OF SYSTEM INVESTMENT COSTS PER NEW WATER HEATER

3.

INCREASE SYSTEM LOAD FACTOR. With off-peak control more kilowatt hours can be sold without exceeding a given peak demand, and the return on system investment is greatly increased.



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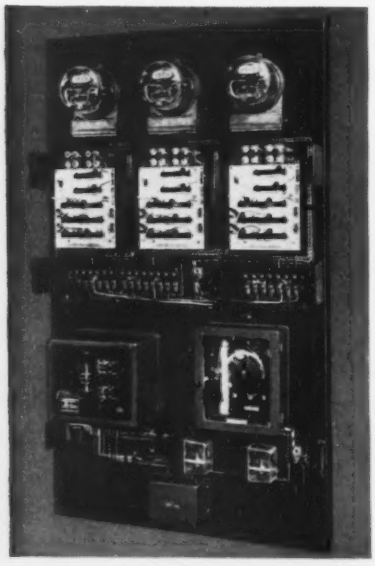

HERE ARE TESCO Transformer-Loss Compensators on a two-element 6.6 KV 18,750 KVA metering installation with three transformer banks. Metering is compensated to the 66 KV dual service supply. Compensator and panel covers removed.

EASTERN

SPECIALTY COMPANY

PHILADELPHIA 40, PA.

Year-Round Use Is Seen for Room Air-Conditioners

Room air-conditioning soon will expand into a year-round activity, predicted W. P. King, Servel, Inc. Addressing the American Institute of Electrical Engineers' conference on application of motors to air moving equipment at Fort Wayne recently, King declared that addition of resistance heaters or heat pumps will adapt the units for heating use.

More than 2.5 million motors have been applied in packaged air-conditioners, said M. D. Irvin, Carrier Corp. And 1954 will require about 3.5 million more, he predicted. Irvin said motor cost is a potent force but also mentioned dependability, quality, service availability, and quietness of operation.

Other speakers discussed motors for fans, blowers, evaporators, unit heaters, and furnaces. And many indicated a desire for shaded-pole induction motors in sizes up to $\frac{1}{6}$ hp. Improved efficiency for these motors was demanded. But little concern was shown about starting current, possibly because of the successful application of joint EEI-NEMA-ACRMA specifications.

It was reported that aerodynamic design has quieted fans by uncovering formerly unnoticed motor noise. Several methods of testing were presented but none seemed satisfactory to the group. The most unique involved using tape recorders to compare various devices, then submitting the tape to an auditing group selected to represent customer susceptibility.

Criticism was voiced about differences in voltage at the motor. One speaker questioned "who should bear the expense of motor replacements." It was clear that 115-v units will continue to be made up to $\frac{3}{4}$ hp, with adequacy of wiring the binding limitation.

Boosting Electric Heating

Industrial Electrification Council, New York, has announced plans for a program to acquaint industrial users with the advantages of industrial electric heating and methods of using it in the production processes. Program includes (1) preparation of a brochure of educational and promotional material already available, (2) a National

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COMING UP...1,733,200 hp

Excavation for "The Dalles" Dam and Powerhouse Starts as Baldwin-Lima-Hamilton Begins Manufacturing the World's Most Powerful Adjustable Blade Propeller Turbines

THE DAM AND POWERHOUSE at The Dalles begin to take shape as this huge earthmoving equipment goes to work.

Work is now under way in Baldwin-Lima-Hamilton Corporation's Eddystone (Pa.) plant on the first of the fourteen hydraulic turbines they are manufacturing for the Corps of Engineers, U. S. Army, project at "The Dalles." The most powerful adjustable blade propeller turbines in the world, each is rated 123,800 horsepower, 85.7 rpm under 81-ft head. Delivery of these turbines is scheduled to extend through July 1959.

Meanwhile construction of the dam and powerhouse is progressing at The Dalles, Oregon, which is located on the Columbia River between the Bonneville and McNary Dams. When completed in 1960, this project will fulfill a dual purpose. Aside from being a power development, it is also the Corps of Engineers' fourth stage of development of the Columbia River in the interest of navigation at The Dalles.

THE DALLES DAM—Ultimately the power house will contain 22 Hydraulic Turbines with a total rated capacity of 2,723,600 hp.

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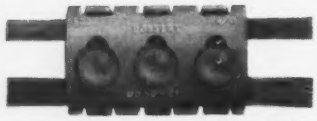
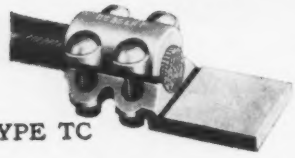


TYPE UD



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Load cannot slip even if handle is accidentally released — because of dual Ratchet and Pawl principle, developed by Coffing and an outstanding Coffing advantage for over a quarter of a century.

Load is held positively at all times — there is no friction brake to slip or freeze.

Hooks will not break or straighten out.

"Safety-valve" handle will bend before any other part of hoist gives way.

Safety-Pulls are single-chain tested at 100 percent above warranted, rated capacity.

Find out more about how Coffing Safety-Pulls provide extra protection on the job. Write for Bulletin E10SP.

Coffing Safety Pull Ratchet Lever Hoists
2 coil chain models, ¾ and 1½ tons
10 roller chain models, ¾ to 15 tons

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Load Binders

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ORIGINATORS OF RATCHET LEVER HOISTS
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Industrial Electric Heating Conference to be held in Cincinnati Jan. 18-22, 1954, and (3) and preparation of a package course of instruction in the application of electric heat and the design of metal sheath heating jobs for presentation, as a school, for utility power salesmen and appropriate industrial groups.

Southwest Firms Discuss Economic Generation

Southwestern Public Service Co and General Electric Co played host last month to representatives of 16 power companies, colleges, and consulting engineering firms at a conference at which effects and evaluation of line losses on incremental system loadings were discussed. Meeting was held at Amarillo, Tex.

L. K. Kirchmayer, analytical engineer for GE, told the gathering that higher cost of fuel, increased distance of generating stations from the load, and more extensive interconnection of systems demand refinements in generating scheduling to deliver power at the least cost. Practical analytical methods have been developed to account for the effect of line losses on the scheduling of power generation, he said.

J. Alton Miller, operating superintendent for Southwestern PS, reported on merits of economic generation studies as it affected his company's operation and said they have paid off handsomely. "In fact," he declared, "we estimate that we have saved three times the cost of the studies by being able to determine accurately the power to transmit from given power plants to given load areas."

Following this evaluation of generation scheduling to a specific company's operation, Kirchmayer said: "Various studies of this type have indicated that a savings of $50,000 a year per 1,000 Mw installed are about the average available from the inclusion of the effect of line losses on the incremental loading of generators. These savings will vary from practically zero for a closely connected metropolitan system to maximum for a system with long transmission lines and a wide variation of fuel costs."

Discussing effects of generation scheduling on system planning, George W. Dupree, Southwestern PS

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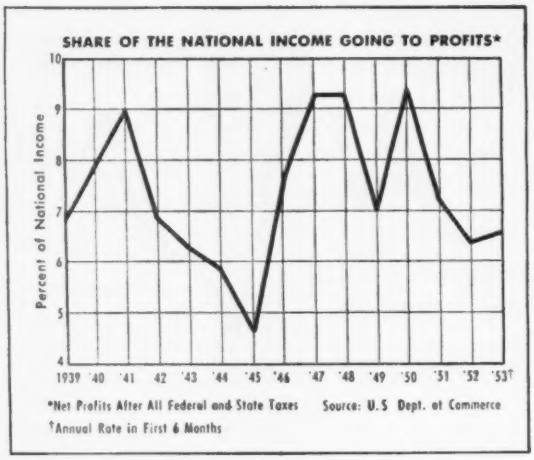
The first of two articles on profits

PROFITS...How High Are They?


SHARE OF THE NATIONAL INCOME GOING TO PROFITS*
Percent of National Income
10
9
8
7
6
5
4
1939 '40 '41 42 '43 '44 '45 '46 '47 '48 '49 '50 '51 '52 '53†
*Net Profits After All Federal and State Taxes
Source: U.S. Dept. of Commerce
†Annual Rate in First 6 Months

How high are profits? What is being done with them? This is the first of two articles designed solely to throw some factual light on these key economic questions.

One of the important economic developments of 1953 has been a substantial increase in the dollar volume of corporation profits from the level of 1952. But to answer the question "How high are profits?" we must also measure them: 1) by comparison with the record of previous years, and 2) as a share of the total national income. The term "profits," as used here, refers to profits *after taxes*. These are the only profits that can be paid to stockholders or retained for use in the business.

In the first six months of 1953, corporate profits *after taxes* were at an annual rate of $20.4 billion. This was higher than in the first half of 1952, but lower than in the full years 1948 or 1950, or in the first half of 1951. If allowance is made for the declining value of the dollar, this year's net profits for all corporations represent less purchasing power than those made five or six years ago.

Here is the record of profits over the years:

	Net Profits After Taxes of All U. S. Corporations	
	Billions of Dollars	
	Actual	In 1953 Prices
1929	8.4	14.6
1939	5.0	9.8
1947	18.5	22.1
1948	20.7	22.7
1949	16.3	18.3
1950	22.7	24.6
1951	20.1	19.7
1952	18.6	18.7
1953*	20.4	20.4

*Annual rate, first six months

The record shows that real profits have a little more than doubled since 1939. This increase, however, does not mean that corporations are doing exceptionally well. The entire national income has doubled since 1939. And our industrial plant is more than twice as large as it was in 1939. Therefore, profits have just about kept pace with industrial growth.

Return on Investment

How high are profits compared with sales, or compared with the stockholders' investment?

What is the rate of return to the people who have invested their savings in corporate business?

The table below shows that for the past three years the rate of return on both sales and investment has been substantially below the return achieved in earlier postwar years. The rate of return on stockholders' investment is higher now than it was in 1939. But this is primarily because today's profits are reported in terms of today's prices, whereas much of the investment in plant facilities is still carried on the books at prewar prices, which are substantially below the cost of replacement. The current rate of return, measured as a percentage of total corporate sales, is below prewar levels.

	Corporate Profits After Taxes	
	Per Cent of Total Sales	Per Cent of Stockholders' Equity *
1929	6.1	NA
1939	4.1	4.0
1947	5.3	14.8 average
1948	5.3	
1949	4.4	
1950	5.3	
1951	4.1	11.8
1952	3.6	10.3
1953#	3.7	10.8

* Manufacturing corporations only
NA Not available
Annual rate, first six months

In considering these figures, it should be remembered that they are averages for all corporations. Some companies make more than the average, and many make no profit at all. In every year since 1915 at least 25% of all corporations have operated at a loss. In 1939, 58% of all corporations were losing money. This year the figure will probably be at least 30%. The improvement since 1939 shows a much healthier economy. But it does not indicate that profits are easy to make.

How Big a Share of the Pie?

The most important single fact about profits is that they now represent a *smaller* share of national income than they have in past years of normal prosperity. For the past three years, profits have taken a smaller share of the pie than in 1939, and considerably smaller than in the early postwar years. Here, as the chart at the beginning shows, is the record:

	Corporate Profits After Taxes as a Percentage of National Income
1929	9.6
1939	6.9
1947	9.3
1948	9.3
1949	7.5
1950	9.4
1951	7.2
1952	6.4
1953*	6.6

*Annual rate, first six months

The main reason for the declining corporate share of national income is, of course, the increasing share taken by the federal government in the form of taxes. The wage earners' share is also higher than in 1939. But the really startling increase is in federal taxes. Taxes on profits now equal almost 8% of the national income, compared to only 2% in 1939.

Why This Is Important

It is important that these facts about profits and taxes be widely understood. At its next session, Congress must consider what to do about the emergency taxes on profits enacted after the outbreak of the Korean War. The so-called excess profits tax is scheduled to die on January 1, 1954. In the absence of new legislation, the rate of the corporate income tax will drop from 52% to 47% on April 1. Many factors, including the revenue needs of the government, must enter into the decision whether or not to reduce taxes. But one fact stands out clearly: By comparison either with past years or with the total national income, corporate profits today are relatively low.

* * *

The second article in this series will discuss what corporations do with their profits.

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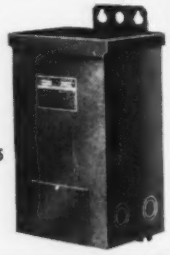

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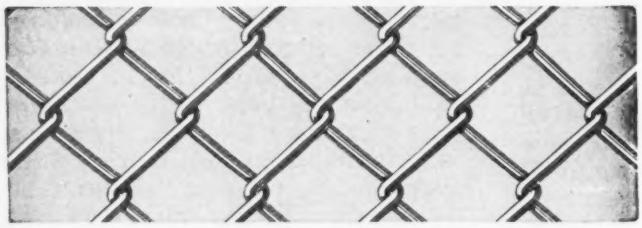

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system planning engineer, declared that line loss considerations as they affect generation scheduling should be taken into account when determining plant location, conductor size, and system connections.

Atlantic City Electric Co Forms Safe Driving Club

Atlantic City Electric Co has formed a "Life Safer Club" for its employees in an effort to promote defensive driving on the highways. More than 900 of the company's workers have enrolled as members and they are being encouraged to get their friends and neighbors to sign up too.

Members of the club receive membership cards outlining ten rules of good safe driving. These are (1) "Consider every intersection an accident trap, (2) give the other driver the right of way, (3) approach legal speed limits only on straight roads, (4) pass only with full clear vision, (5) move from traffic light stop with caution, (6) always park a safe distance from highway, (7) if drinking, don't drive—if driving, don't drink, (8) if drowsy—stop and walk around (9) remember, the pedestrian has rights too, and (10) if in doubt—stop."

Power Uses in Industry Discussed at Meeting

Costs can be cut, production increased, and quality improved in many foundry operations through the use of electric heat, R. E. Sherman, Gordon Hatch Co, told the Great Lakes Power Club at its fall meeting in Milwaukee, Oct. 2.

He cited as examples of electric heat applications that had proved profitable for manufacturers and good load builders for utilities the following: skin drying of molds, core wash drying, heating of permanent molds, preheating of castings prior to welding, spot radiant heat to improve worker comfort and increase their productivity, core baking, melting wax in the lost wax process; shell molding process, and ladle drying.

Another speaker, Carl Cassidy, General Electric Co, told the meeting that improved methods are made possible in industrial plant electrical distribution by use of armored cable and

ELECTRICAL INSULATION IS OUR SPECIALTY

Q. *What ONE wire and cable producer grows its own natural rubber, and makes its own synthetic rubber?*

A. UNITED STATES RUBBER COMPANY.

Q. *What ONE wire and cable producer makes plastics?*

A. "U. S."

Q. *What is the most important part of wire and cable?*

A. The insulation.

Q. *Who is best equipped to make wire and cable with superior insulation?*

A. U. S. RUBBER—which grows its own natural rubber, makes its own synthetic rubber, manufactures its own plastics.

Tapping rubber from one of the millions of trees on U. S. Rubber's giant plantations in Malaya.

Isn't it logical that a rubber company should make the best wire and cable insulation there is? U. S. Rubber has been a pioneer in insulation for over 70 years—has amassed in that time a stockpile of research data and experience that can't be beat. Electrical insulation is a "U. S." specialty!

Electrical insulation makes the difference between superior and ordinary wire and cable. Conductors of all manufacturers are standard, but insulation must be the best that science can produce. That's why your best bet in wire and cable is U. S. Rubber.

SOME MORE OF THE MANY DIFFERENT VARIETIES OF "U. S." WIRE AND CABLE

UTILITIES: Power Cables • Street Lighting • Royal Cords • Network Cables • Utility Control • Pole & Bracket Cable • Service Entrance • Weatherproof • Zip Cord Pole Fixture Cable • Sup. Control

RAILROADS: Power Cables • Communications • Railway Signal • Royal Cords • Welding Cable • Railway Utility • Sup. Control • Weatherproof

HEAVY INDUSTRY: Power Cable • Royal Cords • Welding Cables • Control Cables • Machine Tool Wire • Building Wire • Switchboard Wire • Thermostat Cable • Bus Drop Cable

Absolute Tops in OZONE MOISTURE HEAT Resistance

U. S. RUBBER'S BUTYL-INSULATED POWER CABLES

These cables are for use on power distribution, street lighting and station control circuits and for general-purpose wiring on circuits up to 8000 volts between phases and at conductor temperatures up to 80 C. The insulation will not crack after four hours in air containing 0.015 per cent ozone. They are light in weight, easy to install and join, and are resistant to oil, heat, sunlight, flame, acids, alkalies and corrosive chemicals. The following are guaranteed test values:

PHYSICAL AND AGING PROPERTIES (MINIMUM VALUES)

	Butyl Insulation			Neoprene Jacket	
	Unaged	After 168 Hrs. in O.B. at 80 C.	After 7 days in Air Oven at 250 F.	Unaged	After 96 Hrs. in O.B. at 70 C.
Tensile, lbs. per sq. in.	600	500	400	1800	1600
Elongation, per cent	400	350	350	300	250

MOISTURE RESISTANCE (MAXIMUM VALUES)

a. Dielectric constant and power factor of insulation after immersion in water at 50 C.

Dielectric constant, one day	4.0
Per cent gain, 1 to 14 days	2.0
Per cent gain, 7 to 14 days	1.0
Power factor, one day, per cent	2.0

b. Mgs. per sq. in., 7 days at 70 C. 15.0

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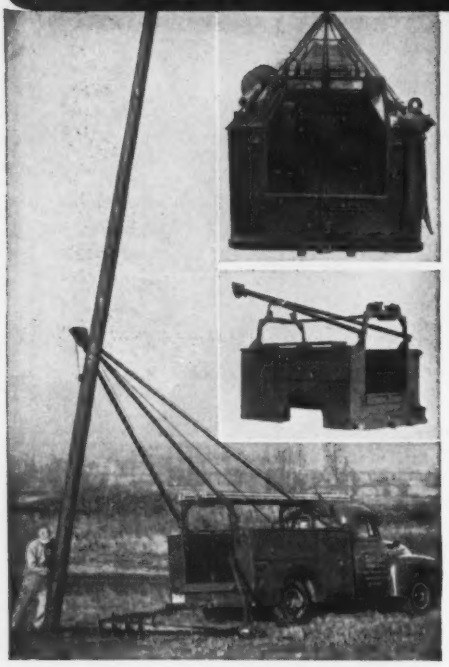

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aluminum ladders designed especially for supporting such cables. Advantages of this system, he said, include lower costs, savings of time in making layouts, smaller space requirements, and reduction in installation time.

Rapid growth of the electrical system at Miller Brewing Co to keep pace with plant expansion was described jointly by M. W. Stehr, Wisconsin Electric Power Co, and Hans Ederegger, L. L. Weldy & Associates. A growth in production capacity of 630,000 barrels of beer in 1946 to present capacity of 3 million barrels a year was accompanied by growth in electrical load from a demand of 650 kw to 4,300 kw. This ratio indicates a greater use of electricity per unit of production, Stehr and Ederegger said, and they attributed it to use of more electrical instead of steam refrigeration, greater use of conveyor lines in the production process, and increased use of electricity for other operations.

Southern Nevada Power Rejects Energy Contract

Contending that the cost of bringing Arizona power into the Las Vegas area is too costly, Southern Nevada Power Co early this month advised the Colorado River Commission that the company would not contract for a 30,000-kw block of power it had previously requested.

Instead the company plans to build a $5.5 million steam plant with an initial capacity of 30,000 kw. Southern Nevada Power now purchases all of its power from the commission.

The Colorado River Commission recently completed negotiations with Arizona Power Authority to purchase 30,000 kw of steam-generated power from that state for sale to Southern Nevada Power. However, the utility had qualified its request by stipulating that if the price proved too high the company had the right to terminate the letter of intent.

Company officials reported that an analyzer study showed unexpected problems in transmission which would add to the cost of the Arizona power. Engineers for the utility estimated that with additional construction and transmission costs included, Arizona power delivered in Las Vegas would cost 9.17 mills per kwhr. Present minimum cost of kwhr to company's customers is 5.0 mills.

This voltage regulating relay doesn't just minimize wear... it eliminates it!

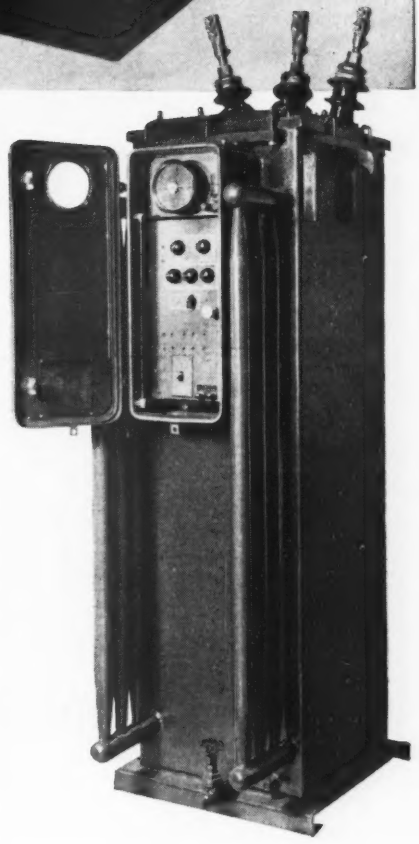
As you know, the voltage regulating relay in any regulator is its most vulnerable point where sustained accuracy of regulation is concerned. That's why Westinghouse has incorporated spring-hinged voltage regulating relays in the new Type SU Induction Regulator.

Because there are no mechanical bearings or pivot points, wear is completely eliminated. Laboratory tests, for example, have subjected this spring-hinged relay to 100 million operations which simulate over 200 years of actual field service! At conclusion of the test, the spring-hinge showed no signs of fatigue—the relay adjustment had not varied from its original calibration.

This exclusive design feature and others such as "all-electric" simplified control panels, heavy-duty silver contacts and air-sealed tanks make these new Westinghouse Type SU Induction Regulators the most accurate and durable for your feeder applications.

Available in the complete line of standard ratings, Type SU Regulators are used separately on single-phase feeders or in conjunction with other single-phase regulators on three-phase feeders. Call your Westinghouse representative for further information, or write direct to Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Pa.

J-10409



Single-Phase Type SU Regulator

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Save 15 to 30 minutes per splice

- **HERE IS AN ACSR PRE-SPLICE CUTTING TOOL** that cuts the aluminum strands in seconds—without damaging the supporting steel core. Cutting stops automatically when core is reached.
- **SWIFT, ONE-STROKE ACTION** — replaces the tedious hacksaw method. You get clean edges that help assure a clean splice.
- **TWO STYLES** — Made with hickory handles for cutting hot or cold lines in ACSR sizes from #6 to 4/0. Larger cutters for cables from 266,800 CM to 715,500 CM (max. outside diameter 1.09") are made with forged steel handles.
- **WELL-BALANCED, LIGHTWEIGHT, TESTED** — These tools have the same exclusive features found in Interstate Hot Line Cutters and Bolt Cutters. Simple geared action, with only 4 movable parts. No complicated mechanism. No delicate adjustments.

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Special Products Division

4085 W. Capitol Dr. Milwaukee 16, Wis.

Maintenance Problems

(*Continued from page* 113)

with no difficulty, tubes were replaced again from a new shipment. Scarcely any of them would work in any of the amplifiers.

E. Faults of some of the more special tubes:

Thyratrons—Tendency to develop excessive grid currents.

Phototubes—Lack of uniform and constant characteristics.

VR tubes—Tendency in some cases for abrupt changes in regulating voltage. Occasionally VR 75 tubes produce as high as 95 v after a few months of operation.

Maintenance Practices . . . Thorough testing before placing equipment in service is one of the best deterrents to faulty operation. Such testing should consist of:

Checking wiring for accuracy.

Inspecting solder connections.

Lowering and raising supply voltages to test range of operational reliability.

Checking to see that all tubes and components are being operated well below rated value.

Testing to see how the equipment performs with weak tubes.

Checking final accuracy of calibration or control.

If many devices of the same type are in use, spare units of each type should be kept on hand.

In the case of relays and switches it is essential that a strict maintenance program be instituted. Frequency of maintenance depends on the application. It can be overdone.

In general tubes should not be replaced just because they have been in service a given length of time. A tube test about once a year is justified.

Maintenance of equipment involving thousands of electron tubes is an engineering problem. It consists of having well trained personnel, good laboratory testing and repairing facilities, and of knowing intimately each circuit and its eccentricities.

If such a maintenance system program is established by any system using numerous electronic applications, the results are certain to prove profitable in savings of time and money. Though they are not measurable, there will be other important gains such as more reliable, and therefore better, system operations and improved morale among employes.

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plugs 'em fast-to last!

DUXSEAL is a nonhardening adhesive plastic compound made with an asbestos base. It is the ideal general utility sealing and caulking compound for duct openings, potheads, bushings, terminal boxes, and for filling multi-wire contact boxes indoors. Use it like putty, just as it comes from the handy package, for smooth, workmanlike jobs.

Duxseal stays plastic—will not slump, melt or run under ordinary temperatures. Clings to duct walls and cables but flexes with expansion and contraction. It is unaffected by water and gases, does not react with rubber, metals or painted surfaces. For full information write Johns-Manville, Box 60, New York 16, N. Y. In Canada, 199 Bay St., Toronto 1, Ontario.

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SEALING COMPOUNDS

CATALOGS • BULLETINS

● **BOX AND CONDUIT SUPPORTS:** Catalog 52 A covers an entire line of Bar Hangers and supports for electrical conduits, cable and outlet boxes. Attachment to and application in wood structurals, suspended ceiling wiring and concrete pour is illustrated and explained. The exclusive Fast-Lok snap-on studs for attachment of outlet boxes without special clamps, locknuts or tools, is a feature of these nail-up or staple-on supports. Write for 52 A to Fast-Lok Manufacturing Co, Ash St at Bedford, Bridgeport 5, Conn.

● **MECHANIZED BOOKKEEPING MACHINE:** Booklet AB 848 covers a new Remington Rand machine which posts all records, and each charge or credit in one writing. The accounts receivable operation yields a complete statement, ledger, journal and deposit slip. The accounts payable operation yields a complete ledger and journal. The payroll operation yields a complete statement, earnings record, and journal. The machine may also be used for general ledgers, inventories, and cost and commission records. Write to Remington Rand Inc, 315 Fourth Ave, New York 10, N. Y. and ask for booklet AB 848.

● **ELECTRIC HEAT TREATING AND BRAZING:** The following bulletins have been announced by the General Electric Co.

GEA-5797 Annealing of Malleable Iron
GEA-5912 Heat-Treating Equipment for Aluminum
GEA-5889 Furnace and Induction Brazing
Write to Section GEO-73-3 General Electric Co, Schenectady 5, N. Y. for any one or all of these bulletins.

● **POWER-LINE CARRIER EQUIPMENT:** Booklet 84-000, 16 pages, covers the new Type FD power-line carrier equipment for relaying, telemetering, supervisory control, remote control, tele-typewriter service, and telephone service. Write to Westinghouse Electric Corp, Dept TP-286, 2519 Wilkins Ave, Baltimore 3, Md.

● **MAKING TRAINING FILMS:** A 20 page booklet entitled "How To Make Your Own Slide Film Presentations for Less Than $20," has been announced. Effective training presentations using magnetic tape and 35 mm slides can be produced. The book outlines the five steps on how to make the picture script, take the pictures, organize the slide sequence, arrange recording session, and tape-record the commentary. Write to Minnesota Mining and Manufacturing Co, 900 Fauqier St, St. Paul 6, Minn.

● **ELECTRIC KITCHEN & LAUNDRY PLANNING:** How to design the kitchen and laundry for attractive appearance and maximum efficiency is presented in a 48-page manual by Westinghouse. The most efficient use of space and the most practical use of equipment is presented step-by-step and with illustrated examples, diagrams, dimension-drawings, and lighting and wiring circuits. Enclose 50¢ and ask for B-5866, "Kitchen-Laundry Design Ideas" from Better Homes Dept, Westinghouse Electric Corp, Box 868 Pittsburgh 30, Pa.

● **AERIAL CABLES:** Bulletin OK-1064 covers "Dimensions and Characteristics of Okolite-Okoprene Self-Supporting Aerial Cables with Aluminum Conductors." Physical and electrical characteristics and complete dimensional and current carrying capacity tables are included. Light weight and lower cost in comparison with comparable copper conductor cables is featured. Write to The Okonite Company, Passaic, New Jersey for OK-1064.

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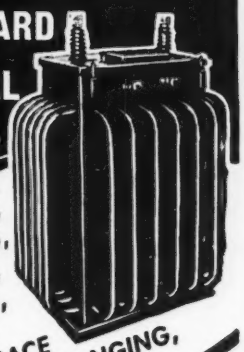

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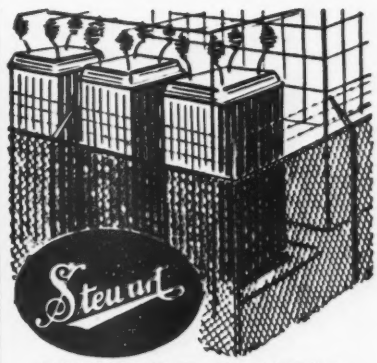

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There's no question about it—a formidable Stewart Chain Link Wire Fence discourages vandalism. And other Stewart products do a bang-up protection job, too. For example: wire window guards, steel folding gates, wire mesh partitions, skylight guards, machinery guards, and others. Don't be half safe—get complete protection—NOW. Stewart catalogs will be sent on request. Please mention products in which you are especially interested.

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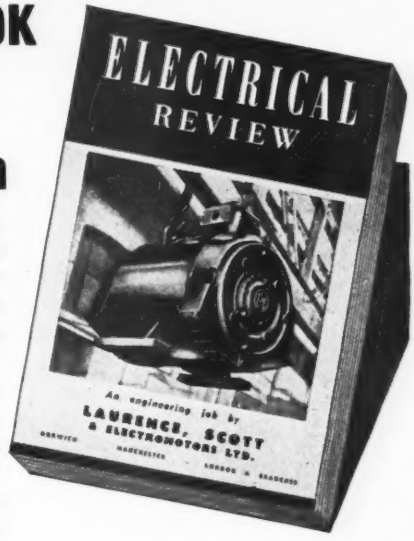
You may have all the information you need about the U.S. electrical industry . . . but what of developments in Britain? Over there, new ways are constantly being found of doing the job more quickly, cheaply and efficiently. The journal with the latest information is ELECTRICAL REVIEW which, week-by-week, records the latest advances in all aspects of British electrical development. Find out what's new in Britain. Read ELECTRICAL REVIEW regularly. 52 information-packed issues cost only $11.00.



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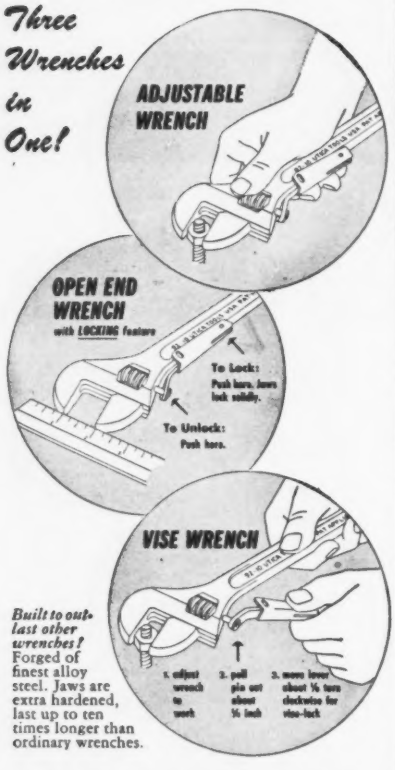

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TECHNICAL LITERATURE

New Electrical Safety Code—The 1953 edition of the National Electrical Code has been announced by National Fire Protection Association. Superseding all previous editions, this edition has been adopted as Standard by the American Standards Association. This revised edition of the code is the result of two years of work by 130 individuals representing home owners, industry, inspection authorities, fire officials, governmental agencies, insurance groups and cooperating national associations. Significant changes and additions affect the following: electrical receptacles, portable electrical equipment, armored cable, mineral insulated-metal sheathed cable, non-metallic sheathed cable, markings for flexible cord and fixture wire, segregation from conductive thermal insulation, elimination of gas piping as grounding method, appliances with temperature limiting devices, fixed electrical space heating, refrigerator motor ventilation, flammable vapor and dusty locations, new rules for garages, hangars, service stations, etc; motion picture studios, elevators, escalators, emergency power and lighting systems, high and low voltage circuits, and television and radio equipment including antennas and grounding. Copies of the new edition of this code are available by addressing NFPA Publications Services, 60 Batterymarch St, Boston 10, Mass. The cost is $3.00 per copy for the cloth-bound edition, 616 pages, which contains 128 pages of excerpts from the significant electrical provisions of 62 other NFPA standards. The paper-bound edition is available at $1.00 each, with quantity discounts starting at over 25. Its text is identical at 488 pages, which excludes the excerpts.

Gas Shielded Arc Welding—American Welding Society announces its 30-page publication titled "The Inert-Gas-Shielded Metal-Arc Welding Process." Welding in inert gas atmospheres is emphasized. The development of the process, equipment required, and necessary controls and their function are described and illustrated. The fabrication of general and complex structures is also covered. Copies are available at $1.00 from American Welding Society, 33 West 39th St, New York 18, N. Y.

DC Power for Electrolytic Processes—Westinghouse announces its 16-page booklet which evaluates the factors that determine the best method of obtaining d-c power for electrolytic processes. The choice between Ignitron rectifier, motor-generator set, or rotary converter is covered along with a discussion of the advantages and disadvantages of private generation of power. Ask for booklet B-5466 from Westinghouse Electric Corp, Box 2099, Pittsburgh 30, Pa.

Demand Meter Manual—Information formerly available only from multiple sources has been published in a new 48 page manual under the title "Manual of Demand Meters—Theory-Economics-Operation-Application". It provides an excellent summary of the principles and problems of demand metering and a reference aid in specific demand-metering application, as well as a clear textbook for students and trainees. Write to General Electric Co, Schenectady 5, N. Y. and ask for GET-2327.

Insulated Aluminum Power Cables: The Okonite Company, Passaic, New Jersey has released 16-page booklet, OK-1070, covering latest information on properties and advantages of insulated aluminum cable. Aluminum know-how is now developed to the extent that economics of the particular application is the selection criteria between copper and aluminum. A section of time-tests on various aluminum conductor fittings is also included. Booklets are available by writing to Okonite Company, Passaic, N. J.

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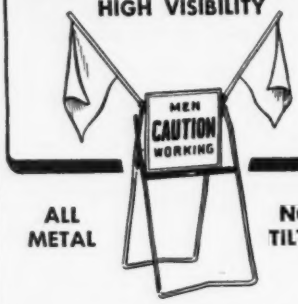

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Other GREENLEE timesaving tools for electrical work: Hand Benders; Joist Borers; Cable Pullers; Knockout Tools; Auger Bits and Drills.

BOOK REVIEWS

Employment Interviewing

The Employment Interview in Industry. **By Newell C. Kephart. Published by McGraw-Hill Book Co, New York 36. 277 pages. Price $4.50.**

This book attempts to treat the problem of employment interviewing in the light of new developments in the field of personal psychology. Newer techniques do not replace the interview as a selection device but rather increase its value and add to the responsibilities of the interviewer. Modern selection procedures demand that the interviewer operate less on the basis of intuition and more on the basis of knowledge and established facts. An extended treatment is given to such topics as: personnel testing, personnel data, physical data and job analysis.

Varied Data

Siemens Formel und Tabellenbuck. **Published by Siemens-Shuckertwerke AG, Essen, Germany. 483 pages, illustrated. Price 18.40 DM.**

Germany's large electric manufacturing company has put out this unique compilation of formulas, tabular data and charted information. No claim is made that it is a handbook (in the American sense) but merely a convenient and authoritative reference book for quantitative information. Text is, of course, in German but a brief glossary should enable anyone to interpret the small amount of text material. Atomic data, measurements, mathematic formulas, conversion tables, thermal properties, alloys, hydraulics, magnetics, dielectrics, motor data, rectifiers, transformer and breaker ratings, cable loadings, illumination, electric heat are typical sections presenting data. There are no advertising pages.

Heating Controls

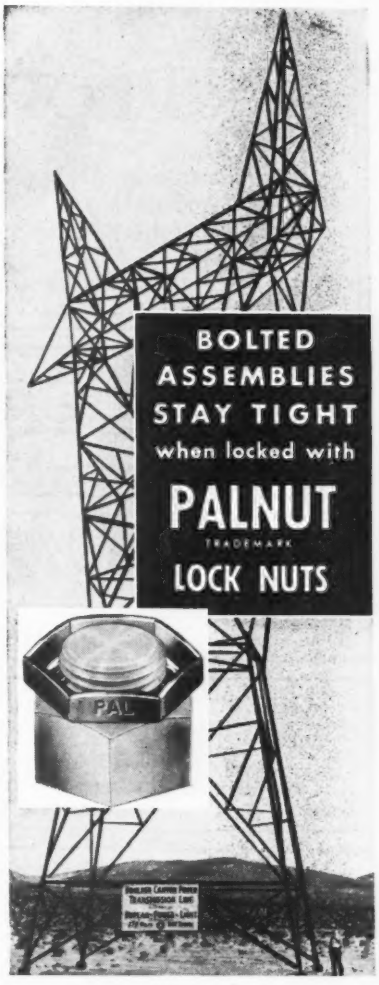
Automatic Control of Heating and Air Conditioning. **By John E. Haines. Published by McGraw-Hill Book Co, Inc. New York 36. 370 pages, illustrated. Price $6.75.**

As the arts of heating and air conditioning have advanced, the automatic control of them has become highly specialized, also the literature of such control. This book does much to simplify that specialization, presenting the elements of automatic control in clear and concise terms. After explaining the fundamentals, the book progresses through the circuits and devices employed, to expositions of control of domestic and commercial heating, of unit heaters and ventilators, of central fan heating and cooling, of commercial refrigeration, and of radiant panel heating.

Timing

Timing Engineering. **By Merten G. Saake. Published by Ribble Engineering Co, Jersey City 2, N. J. 243 pages, illustrated. Price $5.**

Repeating cycle timers and automatic reset timers are the primary subject matter of this book on timed control of mechanical, chemical and electrical processes. The synchronous motor is the heart of the timing action. Schematic and operating details are given for a wide variety of applications among which may be mentioned these; glass polishing, batch process, cycled sprinklers, laundry machines, bulkhead door closure, automatic scales, water treatment, drying and baking tire making; plastic molding and plating operations.



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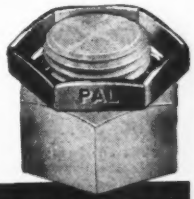

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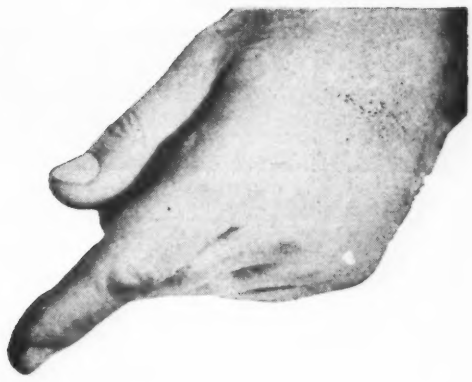

How to keep informed on the "with what" part of your business

AT YOUR FINGER TIPS, issue after issue, is one of your richest veins of job information – advertising. You might call it the "with what" type – which dovetails the "how" of the editorial pages. Easy to read, talking your language, geared specifically to the betterment of your business, this is the kind of practical data which may well help you do a job quicker, better – save your company money.

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$1.20 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.

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SEND NEW ADVERTISEMENTS TO: 300 W. 42 St., 36, N. Y., for Nov. 2nd issue closing Oct. 23rd

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BURBANK, CALIFORNIA

$1018 TO $1267 PER MONTH

Requires: 1. College graduation. 2. 10 years' experience in power, water, or gas utility (combined with water or power). 3. 5 years of the above in planning, directing, and co-ordinating a major division of a public utility.

Write for applications to PERSONNEL DEPARTMENT, CITY HALL, BURBANK, CALIF.

PRODUCTION SUPERVISOR for TRANSFORMER MFG.

Fast-growing Chicago Mfg. of air-cooled transformers has excellent opening for experienced production man. Permanent, bright future, salary open. Give details of experience in letter.

P-9409, Electrical World,
520 N. Michigan Ave., Chicago 11, Ill.

TURBO GENERATOR

Available Immediately
7500 KW G.E. Co.
180 P.S.I.—525°F Total Temp.
3 phase 60 cycle 2300 volt
With Surface Condenser
GOOD CONDITION

Union Electric Co. of Missouri
315 N. 12th Blvd. St. Louis 1, Mo.

OPPORTUNITIES!

in

New and used equipment recently released from service by a number of electric and gas utility companies

POWER PLANT EQUIPMENT
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SUBSTATION EQUIPMENT
TRANSMISSION LINE MATERIALS

Send for new list, . . . to

EBASCO SERVICES INCORPORATED
(APPARATUS EXCHANGE)
Two Rector St., New York 6, N. Y.

REBUILT AND NEW

GUARANTEED MOTORS
M.G. SETS • GENERATORS
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Units of Every Size and Description
WE'LL SELL, BUY OR TRADE
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CHICAGO *Electric Co.*

1324 W. CERMAK ROAD
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FOR IMMEDIATE SALE

TRANSFORMERS

New in original crates manufactured by the Uptegraff Co.
2 Type O.C. 20 to 5 amp., 34.5 KV Current transformers. (outdoor type)
2 Type OPL Outdoor 34,500/115 volt Potential transformers. Price $1,500. F.O.B. Greenville, N. H.

GREENVILLE ELECTRIC LIGHTING CO.
Greenville, N. H.

FOR SALE

CONDENSER

synchronous, 3 phase, 10,000 KVA, 13,800 volt, 60 cycle, 900 rpm, 418 ampere, 8 pole, G. E. type TSC, form HL, serial No. 5185806, with accessories. Manufactured 1929—good condition. For information and bid forms call or write:

TENNESSEE VALLEY AUTHORITY, SALES AND TRANSFER UNIT
116 Lupton Building, Chattanooga, Tennessee—Phone 5-3551, Ext. 673

FOR SALE

COPPER CABLE

38,000-Ft. 4/9, 7 strand, bare copper cable. Has been in use, in good condition. In 42 coils. 30¢ per lb. f.o.b. K.C. Mo.

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WORLD'S LARGEST INVENTORY

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No lengths too long or too short

Telephone: Eastgate 7-4778

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Mr. Electrical Manufacturer

Are you interested in some REAL Sales Representation in the State of Michigan?

RA-9484, Electrical World
520 N. Michigan Ave., Chicago 11, Ill.

REPLIES (Box No.): Address to office nearest you
NEW YORK: 330 W. 42nd St. (36)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

DISTRIBUTION ENGINEER — College graduate with at least five years active experience in electric public utility distribution system design. Good starting salary. Address: P. O. Box 330, Hartford 15, Connecticut.

WANTED — SALES Manager for well known Manufacturer of Power and Distribution Transformers. Salary $15,000 to $20,000. P-9256, Electrical World.

WANTED: ELECTRICAL Engineer for Office and Field Work. Central Illinois Public Service Co., Springfield, Illinois. Att: Electrical Engineer.

DISTRIBUTION ENGINEER—Consulting staff position approximately one year foreign service. Distribution economics, design, standards, and operation improvement large power system undergoing modernization. Excellent living conditions, substantial salary and living allowance, wife accompany. Age 34 to 68. Write P-9478, Electrical World.

ELECTRICAL ENGINEER: We want an experienced man who can take full charge of a well established electrical contracting business. Heavy industrial, some commercial and institution work. Name your own terms. Salary liberal. Bonus. P-9298, Electrical World.

COLLEGE GRADUATE with engineering degree, under 40, Experience required in electric utility rate analysis, cost of service studies, processing applications before regulatory commissions. Must possess capabilities for advancement to executive position. Southern California location. Include picture (if available) giving detailed qualifications. P-9511, Electrical World.

SELLING OPPORTUNITIES OFFERED

SALES ENGINEER, age 25-35, some technical background desirable, to call on utility industry from Chicago office of long established cable company. Permanent position, salary and expenses. State age, educ., experience, refs., sal. SW-9381, Electrical World.

WANTED MANUFACTURERS Agents to represent line of electrical connectors and fittings for the utility and wholesale trade. Territories open in South, Southwest, Rocky Mountain, Northwest and North Central Regions. Advise fully first reply. RW-9377, Electrical World.

AGENTS WANTED—Excellent opportunity to represent established eastern manufacturer of street lighting equipment in many open territories. The agent we want is already established with complete coverage of electric utilities and municipal lighting plants with one or more related lines of distribution apparatus. Write, giving accurate statement of area now served, several public utility references, and all lines now handled. Address reply to RW-9467, Electrical World.

POSITIONS WANTED

EXPERIENCED SWITCHBOARD Operator would like operating job in central or substation. PW-8267, Electrical World.

ELECTRICAL ENGINEER, age 45, desires executive administrative position with utility. Seven years administrative experience on major project planning for American and foreign utilities. Basic background sixteen years in system operations, also experienced in rates, commission cases and special studies. PW-9375, Electrical World.

ELECTRICAL ENGINEER, Age 29, Married, M.S. (Power), 4½ years with large utility, substation design and distribution studies. Desires to relocate, not necessarily with utility. PW-9464, Electrical World.

SUBSTATION EQUIPMENT

TRANSFORMERS

Qu.	KVA	MFR.	Voltage
4	2500	Mol.	69000—13800
4	500	Pitts.	66000/33000—13200/23000 Y
4	500	West.	69000—6900
3	400	G.E.	66000/33000—2300/4160
3	200	Pitts.	66000—2300
3	1250	A.C.	44000/11500—460
4	150	West.	44000/33000—2300/6900
3	75	West.	44000—7200/12470 Y
3	5000	G. E.	38100/66000—6600
4	4500	G. E.	36000—13300—2400
3	3333	G. E.	33000/11000—2400/7200
4	500	G. E.	33000—7200/12470 Y
3	333	G. E.	33000—7200/12470 Y
3	250	Mol.	33000—13800/23900 Y
3	200	A. C.	34500—2400/7200/12470 Y
3	75	Wag.	33000—7200/12470 Y
3	1250	G. E.	26400/13200—2400
4	1500	A. C.	25400/44000 Y—6900/13800
4	450	A. C.	25410/44000 Y—13280/23000
3	1000	Mol.	22000—2300
1	1000	A. C.	22000—2200, 3 ph.
3	100	G. E.	22000—7200/12470 Y
3	50	G. E.	22000—2300
1	600	Stnad.	13200—2300, 3 ph.
1	450	Penna.	13200—2400, 3 ph. ASKAREL
3	250	Pitts.	7200—220/440
3	100	G. E.	7200—240/480M
3	150	Wag.	6900—2300
3	37½	G. E.	6900—230/460
4	150	G. E.	4800/2400—240/120
2	100	G. E.	4800/2400—480/240
3	333	G. E.	2400/4160 Y—240/480
3	250	G. E.	2300/4000 Y—115/230
3	200	West.	2400—240/480
3	150	West.	2400—230/115
1	100	G. E.	2300—575, 3 ph.
6	50	West.	2400—114/228 DRY TYPE

INDUCT. REGULATORS—OUTDOOR

1—140 KVA G. E. 200 A. 4000 V. 3 ph.
3— 48 KVA West. 200 A. 2400 V. 1 ph.
3— 36 KVA West. 150/300 A. 2400 V. 1 ph.
2— 36 KVA G. E. 75/150 A. 4800 V. 1 ph.

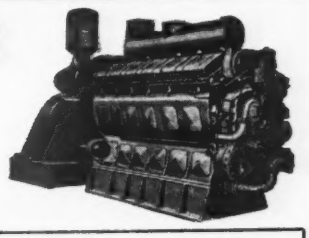
CIRCUIT BREAKERS

4— 800 A. 132 KV West.G-222A-2500 MVA
2— 400 A. 37 KV G. E. FHKO-136-350 MVA
1—1200 A. 15 KV G. E. FKO-139-350 MVA
4— 600 A. 15 KV G. E. FHKO-139-750 MVA

BREW, WOLTMAN & CO., INC.

52 Church Street, New York 7, New York

DIESEL POWER



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• PURCHASE OR RENTAL
UNIT CAPACITIES—10 TO 2475 KVA
A.C.—50 AND 60 CYCLES
• ALSO D.C. UNITS

A PARTIAL LISTING OF OUR INVENTORY

KW	Make	Model	HP	RPM	KW	Make	Model	HP	RPM
1920	Nordberg	TS-217	2800	225	320	Enterprise	DSG-6	560	450
1136	Fairbanks Morse	38D	1600	720	300	General Motors	8-268A	450	1200
1100	General Motors	16-278A	1600	720	200	General Motors	8-268A	350	900
750	General Motors	12-567	1080	720	150	Worthington	CC-4	225	450
800	Baldwin	VO-8	750	514	150	Ingersoll-Rand	S-4	225	600
500	General Motors	8-278A	750	720	150	Buckeye	80	240	600
500	General Motors	8-567	720	720	100	Worthington	BB-5	150	600
480	Worthington	DD-8	700	360	100	General Motors	3-268A	150	1200
400	Ingersoll-Rand	S-8	600	720	60	General Motors	6-71	90	1200
350	Baldwin	VO-6	510	450	30	Internat'l Harvester	UD-14	45	1200

A. G. SCHOONMAKER COMPANY, INC.
DIESEL DIVISION, 50 CHURCH ST., NEW YORK 7, N. Y.

FROM AVAILABLE STOCK

TURBO GENERATORS IN STOCK

Qu.	KW	Make	Desc.
1	1000	G.E.	Non-Cond—190 lbs-2400-3-60
1	1000	Moore	Condensing—Extraction—190 lbs., 2400-3-60—Surface Cond.
1	750	G.E.	Condensing—265 lbs., 440-3-60 Built 1944
1	500	Moore	Non-Cond—150/200 lbs., 5/35 lbs. B.P., 480-3-60 Dir. Conn. Exciter.
1	300	G.E.	Non-Cond—150/175 lbs., 5/10 lbs. B.P., 480-3-60
1	200	Whse.	Non-Cond. 125/150# ISP 5/10# B.P., 240/480 v-3-60

FREQUENCY CHANGERS

Qu.	Kva	Make	Cycles	Voltages
1	12500	Whse.	25/60	13200 x 13200
1	3750	G.E.	25/60	4150/2400 x 2400/4150
1	3125	G.E.	25/60	4150/2400 x 2400/4150
2	2500	G.E.	25/62½	2300 x 4160
1	1250	G.E.	25/58.3	4400 x 2300
1	625	A.C.	25/60	11000 x 2300

MOTOR GENERATOR SETS

3 ph, 60 cy.

Qu.	KW	Make	Speed	DC Volts	AC Volts
1	3000 3U	G.E.	514	600	4000/13200
2	2000	G.E.	450	250	2400
2	2000	G.E.	514	600	6600/13200
1	2000	G.E.	500	666 25 cy.	11000
2	1750	G.E.	514	250	2400
1	1500	C.W.	514	115	4000/13800
1	1500	G.E.	720	600	13200
1	1000	G.E.	900	260	4100/6900
2	1000	Whse.	900	600	2300/4150
1	750	Whse.	900	275	2300/4150
1	500	Whse.	1200	125/250	2300
1	500	Whse.	900	250	440
1	500	G.E.	720	125	2300

TRANSFORMERS—60 Cycle

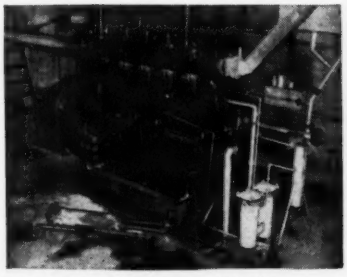
KVA	Make	Type	Ph	Voltages
1—5000	Whse.	OISC	3	33000x26400/13200
1—3500	G.E.	WCT	3	13800 x 2300/440
1—2500	Whse.	OISC	3	26400/13200 x 480
3—2000	G.E.	HVDDJ	1	66000 x 13800
3—1250	G.E.	HVDDJ		6600/550
3—1000	G.E.	HVDDJ	1	2200/480

BELYEA COMPANY, INC.

OFFICE & SHOP
51 Howell St. Jersey City 6, N. J.

185 KW DIESEL GENERATING UNIT

480 V. 3 ph. 60 cycle



Intermediate Speed—Like New

Engine: Ingersoll Rand Type S, 273 BHP 720 rpm, air starting, 5 cyl, 1946 model

Accessories: Woodward Governor, oil & fuel filters, water pumps, fuel & water tanks heat exchangers, starting equip.

Generator: Elliott 231 KVA, 185 KW, 480 v. 3 ph, 60 cycle, .8 pf, with 5 Kw exitor.

Also includes panel board, piping, extra parts and tools.

Write for complete specifications & price

MACHINERY CENTER, INC.

Formerly: Roger Pierce Equipment Sales Co.
808 Newhouse Bldg. Salt Lake City, Utah

-TRANSFORMERS-

BOUGHT AND SOLD

We carry a large stock of transformers, and invite your inquiries. New Transformers built to your specifications.

PIONEER TRANSFORMER REBUILDERS

We rewind, repair and redesign all makes and sizes.
One Year Guarantee.

THE ELECTRIC SERVICE CO., INC.
"AMERICA'S USED TRANSFORMER CLEARING HOUSE"
SINCE 1912 CINCINNATI 27, OHIO

J. L. HEMPHILL & CO.

ELECTRICAL ENGINEERS & EQUIPMENT

1606 53rd ST., NORTH BERGEN, N. J. N.Y.C. Tel.: LOngacre 5-3227 N. J. Tel. UNion 3-2600

TRANSFORMERS

1—1500 KVA G.E., 3 Ph., 4150V. 2300V. Pyranol
2— 750 KVA G.E., 3 Ph., 4150V. 120/240V. sec.
2— 750 KVA G.E., 1 Ph., 4600V. 115/230
2— 400 KVA Pitts., 1 Ph., 2400/4800V. 240/48V.
3— 333 KVA Whse., 1 Ph., 2400V. 600 V. sec.
2— 300 KVA G.E., 1 Ph., 13200V. 220/440V.
1— 200 KVA G.E., 3 Ph., 2400-220 sec.
3— 200 KVA G.E., 1 Ph., 13200V. 440V.

SYNCHRONOUS MOTORS

1— 300 H.P., Elec. Mach., 720 RPM, 3 Phase 60 cyc., 2200V T.E.F Cooled Outdoor service.
1— 150 H.P., G.E., 1800 RPM, 220V, 3/60.
2— 150 H.P., Al. Chal. 360 RPM, 440V, 3/60.

MOTOR GENERATOR SETS

1—1000 KW Whse., 600 V. 720 RPM, 4000 Syn.
1—1000 KW G.E., 600 V. 514 RPM, 4000 Syn.
1—1000 KW Whse., 275 V. 720 RPM, 4000 Syn.
1— 200 KW Whse., 250V., 900 RPM, 4000V. Syn.
1— 150 KW G.E., 126/250V, 1200 RPM, 2300 Syn.
1— 100 KW G.E., 250V. 900 RPM, 2300V. Syn.

SLIP RING MOTORS

2— 500 H.P., G.E., M 1200 RPM 2400 V.
1— 400 H.P., West., CW. 450 RPM, 550V.
1— 250 H.P., West., CW. 600 RPM, 440V.
1— 200 H.P., West., CW. 600 RPM, 440V.
3— 150 H.P., Al. Ch. 1800 RPM, 2300V., 3PH, 60 Cy.

Large Stock of A.C. and D.C. Equipment

All business is specialized

. . . and nothing specializes on your business like your business paper

You can sell suntan lotion on Broadway or Beacon Street, but this seagoing salesman can sell a whale of a lot more . . . because he *specializes.*

Your business is specialized, too. That's why it pays to keep up with your business paper. It specializes on business problems you meet every day. It helps you do a whale of a lot better job by keeping you posted on your whole field. You can *move ahead* when you know what's ahead; you can make quicker, surer decisions when you have a clear perspective on what's happening; and you get all this from your business paper.

Every page counts. The editors gather facts, weigh and interpret them. The advertisers line up new products, materials and equipment . . . tell you what they do and where to buy them. To know what's new that's important to you, read *every* issue—thoroughly! It will keep you one of the best informed people in your field.

This business paper in your hand has a plus for you, because it's a member of the Associated Business Publications. It's a paid circulation paper that must earn its readership by its quality . . . And it's one of a leadership group of business papers that work together to add new values, new usefulness, new ways to make the time you give to your business paper still more profitable time.

A copy of this quick-reading, 8-page booklet is yours for the asking. It contains many facts on the benefits derived from your business paper and tips on how to read more profitably. Write for the "WHY and HOW booklet." Room 2710.

McGRAW-HILL PUBLISHING COMPANY
330 West 42nd St., New York 36, N. Y.

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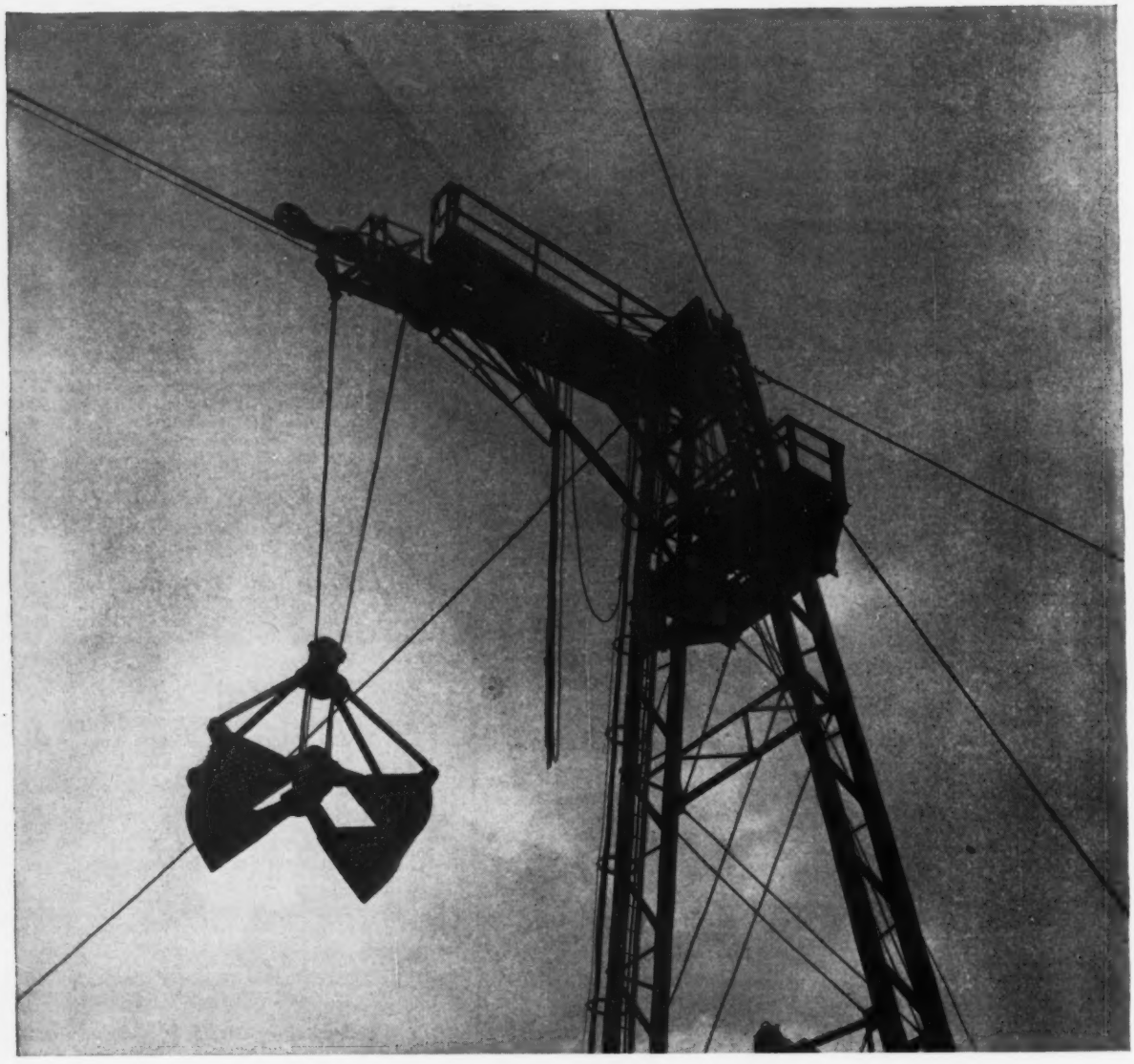

To help you get the most out of your WIRE ROPE

Applications of rope in the power-plant field are highly specialized and usually require careful study. For, if you pick the wrong ropes, even though they are of highest quality, they wear out too soon. This means that you have to buy new ropes prematurely, not to mention the added expense of rerigging.

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But this needless waste can now be avoided; for Bethlehem is fully prepared to give the specific technical aid required in choosing wire rope. Upon request, we will send *to your plant* a qualified engineer who will make a full analysis of your rope applications—without cost or obligation on your part. His study will be designed to help you get the most out of your ropes; to help you pick the *right* sizes and types for power-plant equipment.

So, be sure to ask for this service if you operate car-dumpers, turbine cranes, skip hoists, cableways, scrapers, ash-disposal units, or any other power-plant equipment that uses wire rope. Remember, we're glad to be of help . . . always.

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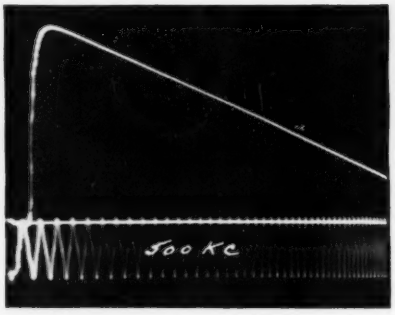

You know you get all the inherent insulation strength possible in an Allis-Chalmers distribution transformer. The oscillogram above — taken from a production line impulse test — proves it. It shows that all the production processes necessary to extend transformer life have been carried out. Not only distribution transformers with protective equipment, but conventional units are tested as well. This is Allis-Chalmers seventh year of production line impulse testing.

Every Allis-Chalmers distribution transformer gets a fast, efficient vacuum treatment to remove air bubbles in windings and oil. The process also assures complete oil impregnation of all fibrous insulation before the transformer leaves the factory.

How the Vacuum Process Works

The photo above shows the operation. While the core and coil unit is still hot from the dry-out oven, it is tanked and covered with hot oil. Then, immediately after final assembly, the vacuum draws out all moisture and any air bubbles locked within the transformer windings.

Many Steps Improve Transformers

This is just one of the many careful steps in design and manufacture that bring you dependable Allis-Chalmers distribution transformers. It means you can count on more transformer service years . . . more economy in transformer operating costs.

For further information call your nearby A-C district office or write Allis-Chalmers, Milwaukee 1, Wisconsin.

A-4148

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